WATER RESOURCES

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HEARINGS

BEFORE THE

SELECT COMMITTEE ON NATIONAL WATER RESOURCES UNITED STATES SENATE

EIGHTY-SIXTH CONGRESS

FIRST SESSION

PURSUANT TO

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ALBUQUERQUE, N. MEX., NOVEMBER 23, 1959

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(Pursuant to S. Res. 48, 86th Cong.)

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WATER RESOURCES

MONDAY, NOVEMBER 23, 1959

U.S. SENATE,
SELECT COMMITTEE ON NATIONAL WATER RESOURCES,
Albuquerque, N. Mex.

The select committee met at 9 a.m., pursuant to Senate Resolution 48, in the court room, sixth floor, Federal Building, Albuquerque, N. Mex.

Committee members present: Senators Kerr (presiding) and Anderson.

Also present: Theodore M. Schad, staff director of the select committee; and Paul McBride, chief clerk.

The CHAIRMAN. I am very happy to again be in Albuquerque, N. Mex., the home State of two of the finest men, two of the best friends that I have in the U.S. Senate, your distinguished senior Senator, Dennis Chavez, and probably the second greatest junior Senator in the U.S. Senate, Clint Anderson.

I have told the people in Oklahoma that they had the greatest junior Senator, and I am so near to Oklahoma that I would not want to publicly make a statement that might be used against me.

But, as I have often said, insofar as representing Oklahoma and New Mexico is concerned, Senator Anderson and I are against any combine we are not in on. He is one of the great members of this committee. He was my campaign manager for chairman of it and has been almost as much benefit to Oklahoma as he has been to New Mexico.

Our committee is seeking to find the answers that arise in the minds of the American people as they realize that our country's population is growing so rapidly and the requirements for both agricultural and industrial products are increasing so fast that we are going to have to act expeditiously and wisely to have the amount of water available in the areas where these great increases in production are going to have to take place.

Otherwise, we will find ourselves shackled in the midst of great opportunities because of failure on our part to move boldly and vigorously in an increased program of conservation of our water supplies.

We have been assigned the task to determine as nearly as we can what the water requirements of our country will be 10 years from now, what they will be 20 years from now, and how those needs can be met and where.

I believe this is the 15th hearing of this kind that we have held. We have had responses everywhere that have resulted in bringing us important and enlightening information, evidence of the people's

realization of their needs and their opportunties, recomendations as to how those opportunities might be implemented to meet those needs, and it is our hope that out of the information secured in this and the other hearings we can take to the Senate a report and recommendations that will be of help to the Senate in meeting the needs of our growing country.

I have a letter here from Senator Chavez which will be made a part of the record at this point.

(The letter referred to follows:)

U.S. SENATE,
SELECT COMMITTEE ON NATIONAL WATER RESOURCES,
November 21, 1959.

HON. ROBERT S. KERR,
Chairman, National Water Resources Committee, U.S. Senate, Washington, D.C.

DEAR BOB: It is with regret that I have been unable to attend the numerous meetings which you have conducted in connection with hearings by the Select Committee on National Water Resources. It is with particular regret that I am unable to attend the meeting in my own State because of the necessity for my inspecting defense installations abroad. However, I am sure that the hearing will be in good hands.

As chairman of the Subcommittee on Rivers and Harbors and Flood Control of the Senate Public Works Committee, you have displayed a keen awareness and a profound knowledge of water resources problems which has been reflected in the legislation which has been encouraged and perfected by our committee. An example of this is illustrated by title III of the 1958 Flood Control Act, which is entitled the "Water Supply Act of 1958", the amendments to the Watershed Protection and Flood Prevention Act, the Federal Water Pollution Control Act, and activities relative to formulation of legislation which will recognize recreational values accruing to all reservoirs.

I believe that the Senate, in authorizing the establishment of the Select Committee on National Water Resources, has taken one of the most outstanding and important actions in recent times. This action provided a basis upon which to appraise our present effort in the field of water development. This action also provided a basis for evaluating the future water needs of our country and suggesting methods whereby our water needs could be satisfied.

I am sure that in your previous hearings, you have heard a great deal of testimony on water problems of those areas. I am also sure that you have visited localities which have a much greater supply of water than we do in New Mexico. However, I do believe that you will not find an area that is more conscious of this problem of water, nor a group of people which has worked more diligently in resolving these problems.

I am sure that during your meeting in Albuquerque, you will obtain a great amount of very valuable information and expert testimony. In view of the amount of data available on matters relative to water resources development problems in the State of New Mexico, I am hopeful that you will obtain from witnesses information concerning the problems of flood control, sedimentation of river channels and reservoirs, irrigation, municipal and industrial water supply, ground water resources studies, salinity control, desalinization of water, weather modification, and the value to the area of water and its uses for recreational purposes.

As I have pointed out, we in New Mexico are not blessed with large amounts of water which are available in other States. However, we do have opportunities to salvage water now wasted through nonbeneficial consumptive use. It has been estimated that the annual evaporation and transpiration losses along water courses in the 17 Western States amounts to more than 25 million acre-feet, or about twice the average annual flow of the Colorado River. It is, of course, doubtful if it is practical to salvage more than about 50 percent of this loss. However, any salvage that can be accomplished will add to the water supply available in the State.

We in New Mexico have a great number of areas where water losses are occuring and presently steps are being taken to correct some of these problems. We are also providing flood and sediment control, irrigation improvement, and other water resources developments. However, to care for expanding population needs, these programs must be accelerated.

I would appreciate it if you would convey to my friends present at the Albuquerque meeting my regrets because of my inability to be present. I would also appreciate your assuring them that I shall continue my unceasing efforts in their behalf, not only in the great water program which is before us, but in every other possible way as well.

With kindest personal regards, I am.

Sincerely yours,

DENNIS CHAVEZ,
Chairman, Senate Public Works Committee.

The CHAIRMAN. I am happy to call on Senator Anderson for such statement as he may care to make and then for him to present the witnesses who are to be heard at this hearing.

Senator Anderson.

STATEMENT OF HON. CLINTON P. ANDERSON, A U.S. SENATOR FROM THE STATE OF NEW MEXICO

Senator ANDERSON. Thank you, Senator Kerr.

Water has been often referred to as one of our Nation's most valuable natural resources. In truth, it is more than just a great resource—it is the very lifeblood of our existence.

Failure of water supplies has spelled disaster in times past in many areas of the world. Here in the West we periodically have experienced drought and have seen our livestock and crops die for lack of water, with resultant human misery and economic chaos. For this reason, westerners are perhaps more conscious than the inhabitants of less-arid regions of the fact that the Nation's water supplies are not inexhaustible.

Each year, the Nation's requirements for water increase at a terrific rate. At present there is no comparable increase in the amount of water available. Thus the water shortage grows at an alarming pace.

I could cite a good many statistics to show the seriousness of our position today, but the committee already has an abundance of this type of information, and I will not repeat it for the the record. Also, I shall leave the testimony of New Mexico's particular problems to our technical people here today.

I only want to say that I fear we in America have indulged ourselves in gross waste of our limited water resources, waste similar to that which we have experienced in the case of some of our other natural resources. One of the first lessons which should be impressed upon every individual in our Nation is that water is a precious, limited commodity—and that willful or careless waste may someday have disastrous consequences. A concerted educational program would play a big part in driving this point home to our citizens.

Secondly, the Nation's leaders must realize that the country's future development depends in a large part upon a coordinated effort to conserve our present water resources. Our population is growing by leaps and bounds. Industry is developing apace. Future prospertity will be governed by proper utilization of our water supplies.

For instance, we have tremendous sources of vital raw materials here in the West. An effort to develop industry close to these sources would prevent further concentration of thirsty industrial facilities in already overcrowded areas. In addition, further dispersion of industry would prevent our entire production capacity from being wiped out in one enemy missile attack. Such a decentralization program

might well call for revision of our present water uses—for instance, we might discover that it is uneconomical to employ so much water for irrigation; that our water could provide a larger per capita income for a greater number of people if it were used in another manner.

As the demand for water grows, attention must be directed toward developing new sources. For instance, we have vast quantities of brackish and salt water that we hope someday to be able to make potable at a price we can afford to pay. It was my privilege to sponsor the saline water conversion bill which became law in the 85th Congress, and I am hopeful that this program will begin to show results in the near future. This law, as you know, provides for a demonstration program in the conversion of saline water.

Another area in which research and experimentation is needed is in the loss of water through evaporation and through consumption by phreatophytes. I hope that some day soon we may be able to do something about these problems.

It is easy to see that America's water problems can be solved only by a united effort and a well-defined and persistent attack. Development of new methods and techniques and planning of projects is a time-consuming process—the design and construction of even a small reclamation project sometimes takes 10 years. Therefore, if we are to meet our future needs, we must begin work immediately.

A large part of the responsibility for developing a comprehensive water program rests with Congress, but Congress cannot do the job alone. There must be a willingness on the part of States and communities to share the burden.

The gravity of the situation has spurred Congress into taking the initiative through passage of Senate Resolution 48, which established the Senate Select Committee on Water Resources, as an initial step.

Senator Kerr said I was his campaign manager for the chairmanship. As a matter of fact, the selection was unanimous. The only problem we had was trying to let everyone of the members of the committee be nominated for chairman which was a little difficult. The committee is also fortunate in having Senator Kuchel, of California, as its vice chairman. I am very happy that these two men, principally Senator Kerr, are taking on this enormous task.

I think, Senator Kerr, it might be well to say here that they have been able to enlist a very fine staff, and I know a wonderful study is going to result from it.

The committee is hopeful that the information that we are gathering will provide a clear picture of our present and future needs, and the extent and character of the numerous water conservation activities now being conducted by local, State, and Federal agencies.

I do not believe I will be disputed when I say that there is today considerable confusion as to what we should do and how fast we should proceed. There is a clear and unmistakable need for an early meeting of the minds on a coordinated national program. Then this program must be put into action without further delay.

We on the committee appreciate the interest of all of you who are here today. I know you come to make a fine contribution to the work of this body. It will be through the efforts of people like yourselves all over the country that we will be able to place the water situation into perspective and evolve a solution.

Now, I have with me some statements that I would like to put into the record.

I had written the Colorado Wildlife Federation with reference to this hearing, and they have mailed me their testimony on the situation in that State as they see it. It is signed by H. Ray Macht, president of the Colorado Wildlife Federation, Pagosa Springs, Colo.

I would like to offer that.

The CHAIRMAN. It will be made a part of the record as requested.

(The information referred to follows:)

STATEMENT OF H. RAY MACHT, PRESIDENT, COLORADO WILDLIFE FEDERATION

My name is H. Ray Macht. I am a cattle rancher in the western mountains of Colorado. I am president of the Colorado Wildlife Federation and this testimony is in behalf of the federation with my own rancher views included and added herein:

The first point that I wish to make clear is that the Colorado Wildlife Federation and other wildlife conservationists are very much in favor of water development projects. We have recorded many individual resolutions approving proposed projects such as the several now being considered or being constructed in the Colorado River Basin.

My second point is the fact that our group is anxious that cooperation may be obtained in the multiple use concept in the use of water and all other natural resources and public property. We are firmly convinced that any people or group of people that want something for their own use only and to heck with the other fellow are simply narrowminded and have no concern for their children or their fellowman, or for the well-being of the Nation. We can still have our reclamation, our hydroelectric power, our industrial processing using water, our flood control, and navigation, together with a good biological wildlife resource in the river systems if wise, considerate, and fair planning is exercised toward all of the multiple use factors involved.

We in Colorado have recently had a very painful lesson in this lack of planning for the future multiple use of water. The John Martin irrigation storage in southeastern Colorado was drained this fall. I believe you are already aware of the tragic lose of fish there. This is also a resting place for thousands of geese. There are many people who live in southeastern Colorado that make a living catering to the needs of the sportsman and recreation of the John Martin Reservoir. If a comparatively small amount of water had been left in the lake in the form of a permanent pool this regrettable loss would have been prevented. Please, may we keep alert to all of the uses of this water resource?

We realize that some projects that are designed for the use of the majority of people do dry up a portion of streams, or ruins a game feeding ground, or perhaps makes a migration route a hazard. In cases like this we believe it is for the common good to provide enough money in the planning of the project to compensate the State game and fish departments for building other fish ponds, planting and developing feed for the game herds, and perhaps fencing the canal hazards on migration routes. We are making great progress in finding that we can have our water resource development projects and at the same time conserve and in many instances improve the biological benefits of a river, but this has required multiple-use recognition and the willingness to make substantial capital investment for all of the various purposes involved.

The wildlife has proven itself very adjustable if just given an even break on environment for good habitat. The idea that fish and wildlife should have only that which might be left over after man takes all he wants is most certainly nonprogressive thinking.

I have lived on this same ranch in Colorado for 46 years. The area here has had considerable gain in wildlife population in those years. I have better quality cattle in flesh and condition than we had in earlier years. This, I believe, is very good proof that multiple use is good use.

Senator ANDERSON. You will also have a letter from the New Mexico Wildlife Conservation Association.

The CHAIRMAN. Senator, if you care to, you might announce that any others who have not completed statements as of today and whose

statements you feel should be part of this record, may be permitted to make their statements part of the record if they will send them to you so you may transmit them to the committee.

Senator ANDERSON. We have, Senator Kerr, as pleasant relationships to the north and to the west as we have to the east, with Oklahoma and Texas, and our Arizona friends are here today. They would like to have had a hearing in Arizona. But Mr. Wayne M. Akin, chairman of the Arizona Interstate Stream Commission and Mr. Arrington, who is appearing for the director of the Arizona Game and Fish Commission, are here and have statements they want either to file or to present.

If Mr. Akin or Mr. Arrington will come forward we will be happy to have them at the beginning of this hearing.

Is Mr. Fox here also? Come up, please.

We will be gad to get all the Arizona folks on at one time.

STATEMENT OF JOHN McHUGH

Mr. McHUGH. Mr. Chairman, I am here on behalf of Mr. Akin to present his statement.

Senator ANDERSON. We do not have your name as yet.

Mr. McHUGH. My name is John McHugh.

Senator ANDERSON. John McHugh?

Mr. McHUGH. McHugh, yes, sir.

The CHAIRMAN. You may proceed.

STATEMENT OF WAYNE M. AKIN, CHAIRMAN, ARIZONA INTERSTATE STREAM COMMISSION, PRESENTED BY JOHN McHUGH

Mr. McHUGH. This statement is made for the purpose of aiding the Senate Select Committee on National Water Resources in the great task which it has undertaken.

Arizona is an arid State. The agricultural and industrial empires which have been created here—reflected in hundreds of thousands of acres of irrigated land, in the temming populations of our cities and in their industrial complex—are dependent for their continued existence upon the development, storage and distribution of water.

The State of Arizona is a party to the Colorado River compact. It it also a part to the Upper Colorado River Basin compact—107,242 square miles of the total area of Arizona lie within the drainage basin of the Colorado River. More than 100,000 square miles of Arizona's land lies within the lower basin. Accordingly, Arizona has an interest, perhaps more vital than that of any other State, in the disposition of the waters of the Colorado River and in the benefits thereof. Notwithstanding this vital interest, the State of Arizona to date has been blocked in its efforts to utilize a fair share of those waters.

The urgent need of Arizona for waters of the main stream of the Colorado is universally recognized. It is appropriate to state also that Arizona receives but a comparatively small portion of the power now produced at hydroelectric plants on the river; that additional hydroelectric plants are badly needed; that the construction and operation of such plants must be planned for the near future; that, in the main, such plants will necessarily constitute an integral part of water storage projects and will contribute significantly to their

feasibility; and that, as such plants are constructed, at least in the Arizona reaches of the river, their major output ought in all fairness to be allocated to Arizona users.

At the turn of the century development in the Yuma Valley had led to the establishment of the Yuma irrigation project—one of the early developments of the Bureau of Reclamation. Later, the use of water in this area was expanded through the construction of the Wellton-Mohawk, the North and South Gila, and the Yuma Mesa projects. These projects are the basis of a large and growing economy in southwestern Arizona. Much remains to be done, however, to complete the coordination of those water uses with uses of the balance of main stream Colorado River water available and allocated to Arizona under the terms of the Boulder Canyon Project Act.

The administration of the Mexican Treaty and uses of Colorado River water in connection therewith emphasize the need for a broad approach to Colorado River Basin problems.

In cooperation with Arizona, the U.S. Bureau of Reclamation in 1944 began active investigation and planning of a project known as the "Central Arizona project," designed to bring supplemental water from the main stream of the Colorado River to central Arizona. The report of the Commissioner of Reclamation on the central Arizona project was submitted to the Secretary of the Interior on May 20, 1948, and was by him transmitted to the Congress on September 16, 1948, with the advice that the proposed project was feasible and that there was urgent need for the water which it would make available.

During the 79th and succeeding Congresses through the 82d Congress, Arizona sought authorization of the central Arizona project. Bills to authorize this project were twice passed by the Senate but failed of passage in the House. On the last occasion when Arizona sought the authorization of this project the House Committee on Interior and Insular Affairs said, in effect, that the State of Arizona should obtain first an authoritative determination of its legal rights in and to the waters of the main stream. Shortly thereafter Arizona brought suit to have its title in and to an appropriate share of such water quieted. Trial of this suit has been had. At this moment the fact and law questions involved are under consideration by a special master appointed by the Supreme Court to take evidence and to make recommendations to the Court. Within the reasonably near future, therefore, the development proposed through works comprised within the so-called central Arizona project will take place. Such development may proceed either wholly or partly through the authorization by the Congress of works under the Federal reclamation laws.

In the days when the proposed central Arizona project was in the planning stage, the State of Arizona had a population of approximately 620,000 people. Its population today is estimated at approximately twice that number, much of which is concentrated in the greater Phoenix and in the greater Tucson areas. The latter, which in those earlier days had an estimated population on the order of 64,000, now has a population of some 240,000. The former, which then had a population of some 120,000, now has a population estimated at 430,000. Twenty years hence, as we are told by a firm skilled in the analysis of population trends, the population in the Phoenix-Maricopa County area alone will be 1,400,000. The cities of Yuma, Casa Grande, Eloy, and Coolidge, in the desert area, Flagstaff, Holbrook, and Winslow,

on the plateau, and Safford and the Gila Valley towns of eastern Arizona, have likewise grown at a rapid rate. Indeed, the same may be said of virtually all areas in our State and of their cities and towns. The need for additional water, urgent heretofore, is now desperate in many areas.

In constructing and in operating the great works that are involved in capturing and storing main stream waters and in bringing them to agricultural and industrial areas as above outlined, the State of Arizona will ever have regard for the solemn obligations which are hers as a signatory of the Colorado River compact and as a signatory of the Upper Colorado River Basin compact. Arizona believes that the Congress should give full consideration to the legitimate aspirations of all of the Colorado River Basin States which seek to achieve that full measure of development for which they may appropriately hope within lawful limits. Arizona has supported the authorization of works in these States in the past and anticipates supporting them in the future.

Accordingly, the State of Arizona anticipates with confidence that the other Colorado River Basin States will in due course lend their support to the authorization and construction of necessary works in Arizona.

Immense population pressures and long-range needs of the country as a whole make full development of the country's water resources a national need. It is gratifying to note that the Senate Select Committee on National Water Resources, by its very composition, recognizes, in effect, that the development, conservation and utilization of water resources for human, agricultural and industrial purposes is of national interest, and that it is no longer primarily a matter of western concern. It may well be that the Congress should consider whether the Federal reclamation program, so intimately connected with water resource development in the Western States, ought to be extended to all 50 States.

The Arizona Interstate Stream Commission and its staff stand ready to cooperate fully and enthusiastically with the Senate Select Committee on National Water Resources and with all other committees of either House of the Congress. The staff of your committee will find us ever ready and willing to be of assistance in technical and other work. Indeed, we shall appreciate having the opportunity to consult with your committee's staff from time to time, so that the report which is, in due course, issude may be as fully meaningful and significant from the point of view of local and practical problems as we believe it will be from the point of view of general policy.

Senator ANDERSON. Mr. Arrington?

STATEMENT OF O. N. ARRINGTON, OF THE ARIZONA GAME AND FISH DEPARTMENT AND COMMISSION

Mr. ARRINGTON. My name is O. N. Arrington. For many years I worked with the Arizona Game and Fish Department and in connection with water and land projects, both State and on behalf of our director, Robert Smith, and our game and fish department and commission.

We appreciate the opportunity of appearing here.

I would like to read the statement for the record.

Senator ANDERSON. You go right ahead, Mr. Arrington.

Mr. ARRINGTON. Thank you.

In behalf of Director Robert Smith, I wish to express the appreciation of the Arizona Game and Fish Department and Commission for the opportunity to appear before this important committtee.

Although we are charged with the administration and management of the wildlife and fish of our State, we wish to stress the skyrocketing needs and demands of people for multiple-use planning in the development of our remaining water resources. We know that if the requirements of people for recreational pursuits are adequately considered, the requirements of our game and fish resources will be assured.

The "people" we speak of is the great, expanding segment of our exploding population that has had only infrequent representation at the many hearings of your committee, and at similar congressional hearings. These "people" include a great portion of the population masses who make a living in our stores, our factories and our services in our communities and cities. They, unfortunately, do not have the time, nor the direct monetary interest in water resources, and thus the incentive to appear at congressional hearings.

To know the great numbers of these "people" we need only to drive on our choked highways near any population center, even in the West, on weekends and holidays. And these "people" are multiplying faster than our exploding population. Census estimates show there will be one-third more human beings in our Nation—57 million more—by 1975, just 15 years from now. The estimated number in the year 2000 can only be an intelligent guess. But shorter working hours, longer vacations, earlier retirement, longer life and greater mobility make the future demands for utilization of leisure time out of doors incalculable. In Arizona fishing and hunting license sales have increased over 30 percent in the past 3 years, while the State population, the second fastest growing in the Nation, has increased only 19 percent. Just as the overproduction of our wheat and corn and cotton is becoming a national issue, so will the overproduction of our leisure time.

The social impact of our exploding population, coupled with more leisure time and greater mobility carries future recreational requirements far beyond the mere desire to get away from an antlike existence in mounds of wood, steel and brick. Unrest, class conflicts, changes in governments and methods of government are recorded throughout history, even to the fall of civilizations, because of social stresses resulting from lack of space and lack of water. Are these not lessons to be gained from our history books to guide us in natural resource management? Must we wait until comparable mass unrest looms on our horizons? When it may be too late?

Certainly a partial solution is indicated in the recent study of adolescent boys. Of the 18 percent of all high school boys 14 to 16 years old who were not juvenile delinquents, 81 percent went fishing.

The control of collective human minds over collective human bodies is well documented, even in our daily newspapers. In the face of such evidence we cannot concur in the contention that we must now plan to use much of our remaining water resources to grow more food and fiber. Not when you can take a soil sample from the back 40 to a soil scientist tell him how many bushels of corn you want to raise per acre,

and receive a seed and fertilizer prescription that will do the job under normal rainfall conditions.

With such farm technology only in the process of development we do not believe the last drop of water in streams and reservoirs must now be assigned for growing crops, even if we were not paying increasing tax billions annually for storing them because of pressures from those whose present standard of living depends on continued and increased crop production.

Nor can we be convinced that plans must be made for water for increasing populations to drink when irrigation wells are drastically lowering water tables to grow more cotton when synthetic fabrics technicians are, to a great degree, making this commodity obsolete.

Although we believe it is only a matter of time until atomic developments will replace dams for hydroelectric power, those interested in creating these dams are rapidly recognizing the multiple water use concept. The resulting reservoirs are providing millions of man-days of water recreational pursuits where none existed before.

In the above comments we have endeavored to show that the tangible dollar is the least of the major benefits to be derived in the future from the use of water in recreational pursuits. Those with single purpose philosophies, those with their minds firmly fixed on profit exclusively, debt retirement or engineering efficiency cannot, we are sure, be converted by citing basic human needs in the less tangible future. Therefore, for those who can only use the dollar sign as a measure, we wish to present some conclusive facts on the dollar value of fishing in Arizona, just one of the recreational pursuits water affords.

In 1956 our department conducted a statistically sound survey of the expenditures of hunters and fishermen in Arizona. Fishermen alone, in the pursuit of their sport, spent $22 million within the State that year. Excluding the Colorado River, there are about 21,000 surface acres of impounded waters in Arizona, at average annual capacity, and about 500 surface acres of streams, suitable for fisheries management and available to the public.

Therefore the licensed fishermen in 1956 spent $1,000 for every surface acre of fishing water within the State available to them. The Colorado River was not included in this analyzation because the majority of those fishing there come from California, Nevada and other States, and made their expenditures outside of Arizona for the most part.

Thus a 50-acre surface fishing lake, the average size our department is developing wherever a water right can be obtained for a suitable impoundment site, is worth $50,000 annually to the economy of the State at 1956 expenditure rates and 1956 fishing license holder numbers. Both have increased. There is no water loss from such a typical lake except by nominal evaporation. No water is being taken out of the vicinity. This averages less than 6 feet per year for an annual water loss of less than 300 acre-feet, would be lost before it reached the farmer's headgate. The 150 acre-feet remaining would grow crops on about 40 acres of land annually.

Therefore if the water used annually on 40 acres of irrigated cropland could be used to maintain a 50-acre surface fishing lake, it would result in at least $50,000 annually to the State's economy. By com-

parison, at fishing lake values, this is $1,250 for water annually to grow crops on 1 acre of irrigated land. And frequently such crops are under Government subsidy.

The $1,000 per surface acre value of fishing waters, you are reminded, represents expenditures of licensed fishermen only. Expenditures for hunting, water skiing, boating, swimming and all the other water recreational pursuits are not included.

To those in many States where water is still abundant—so abundant that industrial wastes pollute millions of acre-feet annually beyond the physical ability of fish to live in it or birds to sit on it—we are sure that the multiple use value of our remaining water resources is difficult to comprehend. We in Arizona and the Southwest can. We believe that a State whose very name denotes "arid zone," and its equally arid neighboring States, is the laboratory where the future necessity of the multiple use concept of water resource use can best be analyzed.

Population migrations to the Southwest, stimulated primarily by the urge of midwestern and eastern residents to find more space in a climate that permits yearlong use of open places, provide the exploding human factor for this laboratory.

It is of interest to note that industry is now a major source of revenue in Arizona, supplanting mining and agriculture. An executive of one of the major electronic concerns stated that an opportunity for excellent community life was of first concern when selecting an area for a new plant, that opportunity for outdoor recreation was second in importance.

Therefore, with the tremendous projected population growth and the arid nature of the area, we believe your committee and Congress can find much of value in the Southwest on which to project your thinking into the future for constructive water resource development legislation.

Where can Congress take positive action that will provide for the multiple use of our remaining water resources and assure the necessary recreational requirements of generations unborn? There are many we have considered, but in the interest of time allocated for this presentation we will stress only two:

1. Provision for fish, wildlife and recreational use of water in all Federal agency water construction projects.

2. Recognition of the necessity of water in the future management and public use of the public lands in any western water right settlement legislation.

Congress has shown great awareness in recent months of the increasing demands on our fish and wildlife resources. The 85th Congress enacted several bills of major importance, probably the most important and far-reaching being the new Fish and Wildlife Coordination Act, Public Law 85–624, and amendments to the Watershed Protection and Flood Prevention Act, Public Law 566. Although this was primarily permissive legislation, it has paved the way for great forward steps by the Army Engineers, the Bureau of Reclamation and the Soil Conservation Service in planning into water control projects provisions for the maintenance and enhancement of fish and wildlife aspects which will provide public recreational facilities.

In the first session of the 86th Congress a number of bills were introduced which would permit more adequate public recreational and wildlife conservation facilities in connection with flood control, navigation and reclamation projects. We trust such legislation will be passed early in the next session.

There is one problem which has not been considered in any proposed or passed legislation which, in Arizona, makes it extremely difficult to benefit adequately from recreational facilities in connection with many Federal water projects. That is the availability of water. As a result, multi-million dollar flood control projects have been completed, been authorized or are in the planning stage which provide only for ungated outlets and no permanent dead storage of water. The Federal construction agencies point out, rightly, that under present interpretation of the State water laws, all the water on the drainage is appropriated for other uses, and therefore none is available for fish, wildlife, and recreation.

While some provisions are made occasionally for partial repayment by local beneficiaries, large expenditures of public funds are always involved. Great direct benefits always result to a small group of residents of the vicinity. Their contributions, usually in the form of easement rights, seldom make up a very large portion of project costs. It seems only reasonable, therefore, that the great segment of the residents in the project area who would use a recreational facility in connection, or who would benefit economically from a recreational facility, should be provided a relatively small permanent water pool if it is feasible from an engineering standpoint. We are sure that only in rare instances would the majority of local major beneficiaries of the Federal project oppose the use of the small amount of water necessary for first filling and evaporation losses.

Increasing interest is being evidenced in Federal streambed and drainage area manipulation projects which will eradicate water transpiring vegetation, including historical wildlife cover, in order to conserve water and for flood control. Primary beneficiaries are local water users who have established water rights on the drainage or in the vicinity. It has been a matter of precedence that all water resulting from such watershed management practices is considered already appropriated.

We would like to submit the contention that such water resulting from channelization and vegetation control operations is, for the most part, new water which has not been available to those who have established water rights. It is, we contend, the same as new water that might be brought from another drainage as a result of a Federal water project which constructed a diversion canal or tunnel from another drainage. As such, at least a small portion of the new water thus created with public funds should be available for the great majority of taxpayers who would benefit from its use in an impoundment for fish, wildlife, and recreational purposes.

Legislation might stipulate that in connection with such Federal construction projects water will be made available for limited use for fish and wildlife purposes in the same manner that certain laws now stipulate access and water easements must be provided by local primary beneficiaries.

There are many proposals before Congress for various types of western water right settlement legislation which would grant State law supremacy over State waters.

We certainly concur in the need for some type of legislation which will clearly define and specify the extent of Federal interest in water resources within State boundaries. We believe, however, that in considering such legislation Congress must carefully analyze existing western State water laws, the history of their enactment, and the general lack of consideration of modern national demands of water resources.

Only three of the 11 Western States, California, Oregon, and Washington, have made any recent major revisions in their water laws. The water laws of the other Western States were enacted when mining, agriculture and livestock were the major activities of the West and are woefully obsolete. They are neither adequate for present-day use nor for the future development of the region.

A recent study of the availability of water for fish, wildlife, and recreational use under existing State laws and court decisions were made by L. C. Binford of Portland, Oreg., a well-known water law attorney who has been active in seeking congressional action to reaffirm Western States control over their waters. In his studies of western water laws he was, in his own words, "shocked to discover that most of these States have laws very unfavorable to recreation, fish and wildlife."

We plead with every Member of Congress, when considering legislation in which the Federal Government will recognize certain western water law concepts, that he familiarize himself with the paper by Mr. Binford entitled "Western Water Law and Policy as It Relates to Fish and Wildlife Resources," prepared for the 1959 annual conference of the Western Association of Game and Fish Commissioners. It is printed in the report of the July and August 1959 hearings before the House Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, Serial No. 9, pages 304 to 312.

We will submit a copy of this paper for inclusion in the report of the hearings of this committee if there is no objection, and if it has not been submitted at a previous hearing.

(The information referred to follows:)

STATEMENT OF L. C. BINFORD, DIRECTOR, IZAAK WALTON LEAGUE OF AMERICA

WESTERN WATER LAW AND POLICY AS IT RELATES TO FISH AND WILDLIFE RESOURCES

For the benefit of those who will sleep through this paper's presentation, or who may never read beyond this introduction, let me sum up in a capsule the thoughts later to be expressed.

Western water law was developed without any consideration for the welfare of fish and wildlife. That legislative enactments and administrative procedures have done little to help the situation and there is good reason for those interested in fish and wildlife management to be thankful that *Pelton* decision has claimed for the Federal Government some control over waters on and adjacent to Federal lands.

Western water law and policy has, since the *Pelton* decision [1] been the subject of numerous papers and published articles.[2]

Most of these articles have had as their primary purpose a criticism of the Court's decision which has, or threatens to, give Federal agencies control over waters of the 17 Western States, thus stripping the States of sovereignty over their waters.

It is not my intention to discuss the conflict that has arisen over State versus Federal control of water. I will state the water law and policy of the Western States as I believe it to be. Some of my conclusions may not exactly agree with others who have written on the subject, but I would urge you to weigh my analysis on an overall basis rather than picking out single details over which there may be differences of opinion or interpretation.

Water in the original Colonies, and in the States that followed, belonged to the land. Those who owned the land had the use of the water. In general, this use must not diminish the flow of the stream in quantity or impair its use for other owners of land adjacent to the stream. This common-law rule of water rights is known as the riparian doctrine.

Western States had as a water policy background this riparian doctrine, but as it did not fill the need of the arid areas, western people superimposed a new concept of use. They needed the water, so they took it. Ownership of land adjacent to water was not a limiting factor of use. Land was mostly public domain anyway, so the miner or the irrigationist ditched the water to the place of use, and by his appropriation he acquired a property right good against all others except prior appropriators. If he quit using the water, he lost his right and the users lower in order moved up to his place—in the scheme of first in time, first in right.

Under this western water law conceipt, a user must actively capture the water and reduce it to possession in order to perfect his appropriation. It wasn't enough to stake out a claim to the water. He must actually divert it from its normal flow and place it in a beneficial use.

Of the 17 Western States, 9 have declared by their constitutions ownership or control over the appropriation of water for beneficial purposes while the other 8 have done so by statutes.[3]

All of these States provide either by statute or administrative order the procedure that must be followed in appropriating water. These vary considerably. As the appropriator is creating a property right, strict compliance with the procedures is generally required.

Once acquired, the right to water becomes a property right, and in general is subject to transfer along with the object of its use, ordinarily using a written document in the nature of a deed to real property. Other than loss for nonuse, the title to the water is in perpetuity. Like any other property, it can be condemned and taken under authority of eminent domain for public use.

My study of this subject was prompted by some discoveries I made about State laws when I was preparing a speech having as its purpose to persuade Congress to restore to the Western States the control over their waters, presumably lost by the *Pelton* decision.

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[1] *Federal Power Commission* v. *Oregon* (1955) 349 U.S. 435. The Supreme Court held that the Federal Power Commission must be sustained in granting a license for a hydro project which would interfere with anadromous fish runs, notwithstanding the disapproval of the State, because the termini of the dam were to be situated on reserved lands of the United States.

[2] "The *Pelton* Decision, a New Riparianism, 1957," by James Munro, Oregon Law Review, vol. 36, No. 3, p. 221.

"Federal Claim for Control of Water Rights Danger to Western States," by Roy J. Sampson, Oregon Business Review, vol. XVII, No. 1, April 1958.

"Western Waters—Property Right in or Nationalization of Which," address by William J. Burke, at The Dalles, Oreg., Sept. 17, 1956.

"State Water Rights," address by Elmer Bennett, U.S. Department of the Interior, at Long Beach, Calif., Dec. 12, 1957.

"Water Rights Under Our Federal System," by C. Petrus Peterson, Lincoln, Nebr., January 1959.

"Federal Encroachments on State Water Rights," address by Clarence A. Davis, at Los Angeles, Calif, Aug. 25, 1958.

[3] Claiming ownership or control of waters of the State:

In constitution:		By statute:	
Texas	1845	Oregon	1859
California	1850	Kansas	1861
Nebraska	1867	Nevada	1864
Colorado	1876	South Dakota	1889
North Dakota	1889	Montana	1889
Washington	1889	Utah	1896
Idaho	1890	Oklahoma	1906
Wyoming	1890	Arizona	1917
New Mexico	1912		

I was shocked to discover that most of these States have laws very unfavorable to recreation, fish, and wildlife uses.

I found that many of these States have laws and permit the appropriation of all of the waters of a stream without regard to the needs of fish and wildlife. In several States courts have ruled that recreation, fish, and wildlife are not beneficial uses.

There is no machinery present in the law for the establishment of a minimum flow for a stream, except in Oregon, Washington, and our neighbor, British Columbia.

In none of the States is there a provision for appropriating water to be left in streams for the use of fish and wildlife that has a status equal to appropriation for other uses.

Several States by constitutional provision, have assigned priority to a certain use, usually irrigation. Some States have provisions against the denial of the right to appropriate water.

With such constitutional provisions there clearly can be no multiple use, comprehensive development of the water resource which would give consideration to all beneficial uses, including fish and wildlife.

In the preparation for this paper I addressed a questionnaire to directors of fish and game departments and to some other officials of each of the 11 Western States, also Alaska and British Columbia, which comprise the Western Association of State Game and Fish Commissioners. Answers to the questions have provided most of the material I have included.

Alaska: Constitution of this, our new State, Alaska, as would be expected is very considerate of fish and wildlife. It provides that:

"All surface and subsurface waters are reserved to the people for common use, except mineral and medicinal waters, are subject to appropriation. Priority of appropriation shall give prior right. Except for public water supply, an appropriation of water shall be limited to stated purposes and subject to preferences among beneficial uses, concurrent or otherwise, as prescribed by law, and to the general reservation of fish and wildlife."

Arizona: The State constitution puts no limitations on use of water, but the legislature has established beneficial uses and priorities with little regard for fish and wildlife, and no mention at all of water for recreation and pollution abatement.

The assistant attorney general, C. C. Royall, of Arizona has provided me with the following quotes from the acts of the State legislature.

"Article 3. Appropriation of water.

"45–141. Right of appropriation; permitted uses; priority.

"A. Any person may appropriate unappropriated water for domestic, municipal, irrigation, stock watering, water power, wildlife, including fish, mining uses, for his personal use or for delivery to consumers. The person first appropriating the water shall have the better right.

"C. When it becomes necessary for the State land department to determine the relative values to the public of proposed uses of water, wildlife uses, including fish, shall be deemed inferior to domestic, municipal, irrigation, stock watering, power and mining uses.

"45–147. Relative value of uses.

"A. As between two or more pending conflicting applications for the use of water from a given water supply, when the capacity of the supply is not sufficient for all applications, preference shall be given by the department according to the relative values to the public of the proposed use.

"B. The relative values to the public for the purposes of this section shall be:

"1. Domestic and municipal uses. Domestic uses shall include gardens not exceeding one-half acre to each family.

"2. Irrigation and stock watering.

"3. Power and mining uses."

R. G. Lynch, writer for Wildlife Federation, says Arizona has the worst water laws in the United States for fish and wildlife.[4]

British Columbia:

"The use of any waters in the Province are controlled by the British Columbia Water Rights Act. No water use is permissible unless authority is received

[4] R. G. Lynch in his booklet, "Our Growing Water Problems," published Apr. 9, 1959, by the National Wildlife Federation, states on p. 36:

"Arizona probably has the worst water laws in the United States for fish and wildlife management. The game and fish department cannot get water rights by purchasing submarginal farmland which has rights. The water is still marked for irrigation."

from the Comptroller of Water Rights, Department of Lands and Forests, Victoria, British Columbia.

"Every application for water use must by law be referred to the fish and game branch, department of recreation and conservation for investigation and approval. If any application is objected to by said branch or any person then a public hearing must be called and conducted by the comptroller of water rights."

The law permits the establishment of a minimum flow.

California: Constitution assigns no priorities for water use, but states:

"It is hereby declared that because of the conditions prevailing in the State, the general welfare requires that the water resources of the State be put to beneficial use to the furthest extent to which they are capable * * *."

The State water code, however, assigns priorities as follows:

"It is hereby declared to be the established policy of the State that the uses of water for domestic purposes is the highest use of water and that the next highest use is for irrigation."

In answer to the question, "Have appropriations of water been made for fish and wildlife uses?" the water projects coordinator writes:

"Numerous water rights are held by the Department of Fish and Game for the diversion and use of water on State-owned waterfowl management areas, fish hatcheries, fish ponds, etc. In addition, the U.S. Forest Service holds State water permits on a number of streamflow maintenance dams in the Sierra Nevada Mountains. Most of these dams were constructed by the department of fish and game under a cooperative program with the U.S. Forest Service. The dams store water during the spring runoff period for release in the late summer and fall months when the stream below the dam would go dry or become very low. Under present law it appears that this water right might be successfully protected only on Federal or State land. Under California law, it is impossible to acquire a water right for the purpose of reserving or maintaining a flow of water in a stream. A prerequisite for issuance of a water permit involves taking the water under some kind of control as by a diversion or impoundment. In other words it is not possible to obtain a water right for the purpose of retaining a portion of the natural flow of the stream. However, in the issuance of water permits the State water rights board has the authority to reserve from appropriation a portion of the streamflow and this has been done in many cases. When this is done it essentially accomplishes a reservation of water for fish and wildlife purposes. However, it must be recognized that such a reservation is subject to future appropriation and, therefore, does not have the strength or protection afforded by a regular water permit."

Colorado: Constitution provides:

"The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the services of all those desiring the use of the same, those using the water for domestic purposes shall have preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes."

There is no provision in the law for appropriation of water for recreation, fish, or wildlife, or to establish a minimum flow.

Idaho: Constitution provides:

"* * * Priority of appropriation shall give the better right as between those using the water; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the same, those using the water for domestic purposes shall (subject to such limitations as may be prescribed by law) have the preference over those claiming for any other purpose; and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes. And in any organized mining district those using the water for mining purposes or milling purposes connected with mining, shall have preference over those using the same for manufacturing or agricultural purposes * * *."

There is no provision in the law for the establishment of a minimum flow. Water can all be appropriated for priority uses named in the constitution leaving the streambed dry.

Water has been appropriated for fish hatcheries and wildlife management areas for the irrigation of management areas and hatchery lands, and for stor-

age in impoundments. The attorney general of Idaho has said that the appropriation was "presumably on the grounds that such use falls within the agricultural use category."

However, irrigation interests prevented the release of water from Lucky Peak reservoir to maintain the needed flow in the Boise River to preserve fish life.

Montana: Constitution names beneficial uses of water as: irrigation, water supply, mining, and waterpower.

There is no law or rule of court recognizing recreation, fish, and wildlife uses as beneficial uses. Appropriations have been allowed for water supply for fish hatcheries.[5]

Conclusion to be reached from three cases in the State's highest court, is probably this: Montana will recognize fish and wildlife uses as beneficial uses of water, but in a conflict as between uses will hold it subservient.

Bills have been introduced in the legislature to name fish and wildlife as a beneficial use, but did not get out of committee.

Nevada: Nevada has very little law on water. Water has been appropriated for ponding for waterfowl and for fish hatcheries.

The fish and game department sponsored a bill along with organized sportsmen in 1957, to establish fish and wildlife propagation as a beneficial use. It was not passed, but the legislative counsel bureau was directed to make a study and report to the 1959 legislature.

The Bureau proposed a water resources policy which would give recognition to fish and wildlife uses, and recreation. Nevada State Reclamation Association and Nevada State Livestock Association blocked its adoption.

New Mexico: New Mexico law does not classify fish and wildlife uses as beneficial, and the 1957 legislature failed to pass an act that would so classify the uses.

The law permits the State administration to declare in a given situation, fish and wildlife uses as beneficial.

The law permits a 10-foot dam with up to 10 acre-feet of storage to be built without a State permit, which provision has been freely used by the fish and game department.

Efforts to maintain a minimum streamflow by limiting diversions have failed.

Oregon: There are no constitutional limitations on water uses or assigned beneficial uses or priorities, leaving the legislature free to enact a model water law in 1955.

By the terms of this act, administration of Oregon's water policy was placed under a board of seven, who must adopt a program for use and control of Oregon's waters. In doing so they must take into consideration all beneficial uses, including pollution abatement, recreation, fish and wildlife.

All uses have equal status except human and livestock uses. The board can classify streams for uses and can withdraw water from appropriation. Minimum flows can be established.

The board may modify its own program of use and control, or change its withdrawals from appropriation and its fixed minimum flows. In this respect public uses—fish, wildlife, pollution abatement, and recreation—do not have as favorable a position as has the use where there has been an actual appropriation of the water.

Utah: Constitution merely states that all existing rights to the use of any waters in this State for any useful or beneficial purpose, are hereby recognized and confirmed.

Utah's Supreme Court has ruled that a valid appropriation under the laws of that State may not be effectuated for wildlife.[6]

Wyoming: Constitution gives certain preferred uses the power of eminent domain over other uses.

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[5] *State* v. *Aitchison*, 96 Mont. 335, 30 P. (2d) 805. Court rules that the fish and game department could not condemn water for rearing ponds, suggesting that water for fish and game purposes is not a beneficial use.

Oanes Livestock Company v. *Warren*, 103 Mont. 284, 62 P. (2d) 206, indicates that a swimming pool or fishpond is a beneficial use.

Quigley v. *McIntosh*, 110 Mont. 495, 103 P. (2d) 1067. Court indicated it would recognize water for a fishpond as a beneficial use.

[6] *Lake Shore Duck Club* v. *Lake View Duck Club*, 50 Utah 76, 166 Pac. 309–310–311 (1917). The court said, "To our minds it is utterly inconceivable that a valid appropriation of water can be made under laws of this State (for wild waterfowl) when the beneficial use of which, after the appropriation is made, will belong equally to every human being who seeks to enjoy it."

"Water rights are hereby defined as follows according to use: Preferred uses shall include rights for domestic and transportation purposes, steam powerplants, and industrial purposes; existing rights not preferred, may be condemned to supply water for such preferred uses in accordance with the provisions of the law relating to condemnation of property for public and semi-public purposes except as hereinafter provided. Preferred water uses shall have preference rights in the following order: First—water for drinking purposes for both man and beast; second—water for municipal purposes; third—water for the use of steam engines and for general railway use, water for culinary, laundry, bathing, refrigerating (including the manufacture of ice), for steam and hot water heating plants, and steam powerplants; and fourth—industrial purposes. The use of water for irrigation shall be superior and preferred to any use where water turbines or impulse water wheels are installed for power purposes; provided, however, that the preferred use of steam powerplants and industrial purposes herein granted shall not be construed to give the right of condemnation."

Water rights have been filed for fish hatcheries and fish use in reservoirs. There are no adjudicated cases, but with constitutional preferences not including fish, wildlife and recreational uses it can be presumed that other named uses could take away fish and wildlife uses.

Efforts to get the legislature or board of control to give public uses—that is, recreation, fish and wildlife uses—equal status with all other uses except municipal and domestic have failed.

Washington: Constitution places no limitation or priorities on the use of water, simply stating that irrigation, mining, and manufacturing "shall be deemed a public use."

The legislature has well protected fish uses of water by creating a sanctuary of streams tributary to the Columbia, and prohibiting dams over 25 feet, and diversions from these streams and others which would result in lowering the flow below the flow necessary to adequately support food fish and game fish populations.

Other laws require fishways and screens at diversions or dams. Even the streambed cannot be disturbed by construction programs without the consent of the director of fisheries and the director of game.[7]

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[7] Revised Code of Washington, 75.20.010. "Columbia River Fish Sanctuary–Established." All streams and rivers tributary to the Columbia River downstream from McNary Dam are hereby reserved as an anadromous fish sanctuary against undue industrial encroachment for the preservation and development of the food and game fish resources of said river system, and to that end there shall not be constructed thereon any dam of a height greater than 25 feet that may be located within the migration range of any andromous fish as jointly determined by the director of fisheries and the director of game, nor shall waters of the Cowlitz River or its tributaries or of the other streams within the sanctuary area be diverted for any purpose other than fisheries in such quantities that will reduce the respective streamflows below the annual average low flow, as delineated in existing or future U.S. Geological Survey reports: *Provided*, That when the flow of any of the streams referred to in this section is below the annual average, as delineated in existing or future U.S. Geological Survey reports, water may be diverted for use, subject to legal appropriation, upon the concurrent order of the director of fisheries and director of game.

R.C.W. 75.20.020. The director of fisheries and director of game shall acquire and abate any dam or other obstruction or acquire any water right which may have become vested on any stream or river tributary to the Columbia River downstream from McNary Dam which may be in conflict with the provisions of R.C.W. 75.20.010. Any condemnation action necessary * * * shall be instituted * * * in the manner provided for the acquistion of property for public use of the State.

R.C.W. 75.20.050. "Water Flow To Be Maintained." It is hereby declared to be the policy of this State that a flow of water sufficient to support game fish and food fish populations be maintained at all times in the streams of this State.

The supervisor of hydraulics shall give the director of fisheries and the director of game notice of each application for a permit to divert water * * * and they shall have 30 days * * * in which to state their objections * * *.

The supervisor of hydraulics may refuse to issue a permit to divert water * * * if in the opinion of the director of fisheries or director of game, such permit might result in lowering the flow of water in any stream below the flow necessary to adequate support food fish and game fish populations of the stream.

R.C.W. 75.20.060. Every dam or other obstruction across or in any stream shall be provided with a durable and efficient fishway * * * as the director may approve.

R.C.W. 75.20.100. In the event that any person or Government agency desires to construct any form of hydraulic project or other project that will use, divert, obstruct or change the natural flow or bed of any river or stream or that will utilize any of the waters of the State or materials from the streambeds, such person or Government agency shall submit to the department of fisheries and the department of game full plans and specifications of the proposed construction or work, complete plans and specifications for the proper protection of fishlife in connection therewith * * * and shall secure the written approval of director of fisheries and the director of game * * *.

It will be observed that the protection given to fish and game by the State of Washington is acquired by giving the fish and game departments a veto or limitation on other uses. While effective as far as these uses, it does not permit a comprehensive development program of water use that takes into consideration all beneficial uses. Certainly, the State fish and game departments' position has not been effective against the Federal Power Commission licensees.[8]

Generally speaking, the conclusion is reached that fish and wildlife uses are dependent on the leavings of water. In the Pacific coastal States where fishing has been of considerable commercial value, fish and wildlife uses fare better, but such legal status as they enjoy has been only recently obtained, after consumptive users have diverted most of the water from the streams.

It would also appear from the study of the water laws of these States that only a few are likely to give recreation, fish, and wildlife equal status with other uses, as their legislatures are mostly dominated by the agriculturists and the stockmen. In several States constitutional changes would have to be made to give fish and wildlife uses equal status with the present preferred uses.

None of the Western States recognize a water right, unless there be an appropriation.[9]

This principle was applied by Utah's Supreme Court to the use of water for livestock.[10]

Even the States that accept fish and wildlife as a beneficial use, and most do not, all apply this theory of appropriation—so to acquire a water right for fish and wildlife there must be a diversion, an allocation of a given quantity from the natural flow of a body of water.

There can be no appropriation or right created for fish and wildlife by leaving the water flowing in the stream or its natural bed. Such a right cannot even be created for livestock.

Under western water law there can be no appropriation of water for the use of a waterfall regardless of its scenic value, or for fishing, or for canoeing, or for drinking by wild animals.

The force of these State laws for the appropriation of water use was drastically reduced by the *Pelton* decision.

The Western States by their elected leaders and water-user groups descended on Washington demanding that their purported sovereignty over water be restored. Senator Barrett introduced such a bill. It and other bills having the same intent have so far failed to get out of committee.

Since the settlement of the West, water rights are acquired by appropriation under State laws and procedures. There is no body of Federal law or established procedures for acquiring water rights, with the exception of the Federal Power Commission.

Those desiring to appropriate water continue to acquire the right under State law. The Federal control over waters appurtenant to its own reserved lands seems in actual application to be applied only in limited situations, especially in the matter of the use of water for hydropower.

Federal water law is based on the riparian concept. It applies only to Federal reserved lands, but most Federal lands that control water are either reserved lands or by administrative order could be made reserved lands. As owners of the land the Federal Government would seem to have rights to the water appurtenant thereto, which cannot be appropriated without its consent.

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[8] City of Tacoma has since 1948 been attempting to build a dam on the Cowlitz River under license from the Federal Power Commission, and has had the issue before five courts. The latest, *City of Tacoma* v. *Taxpayers of Tacoma, et al.*, 357 U.S. 320, in another victory for Tacoma, the Supreme Court holding the city could take by condemnation a State fish hatchery, and quoting with approval, *Washington Department of Game* v. *Federal Power Commission*, 207 F. 2d 391, 396, which stated, "State laws cannot prevent the Federal Power Commission from issuing a license or bar the licensee from acting under the license to build a dam on a navigable stream."

[9] U.S. Supreme Court has said in regard to the water law of Arizona: "To appropriate water and to take and divert a specified quantity thereof and put it to a beneficial use * * * and by so doing, to acquire * * * a vested right to take and divert from this same source * * * the same quantity of water annually forever, subject only to the right of prior appropriations * * * the perfected vested right to appropriate water flowing * * * cannot be acquired without the performance of physical acts through which the water is and will in fact be diverted to beneficial use." *Arizona* v. *California*, 283 U.S. 423, 459 (1930).

[10] "They (defendants) without any diversion, merely permitted animals to drink directly from the creek. That gave them no right to or possession of the use of the waters for * * * it is an indispensable requisite that there must be an actual diversion of the water." *Bountiful City* v. *De Luca*, 77 Utah 107, 292 Pac. 194–199, 72 ALR 657.

In actual practice, State agencies even though denied control over certain waters in the State forum, may accomplish the desired result by a proper presentation to the Federal forum.

City of Eugene, Oreg., made application to the appropriate State agency and the Federal Power Commission to build a hydroelectric power dam, called Carmen-Smith project, on the McKenzie River, a famous recreation area and fishing stream.

Oregon Water Resources Board, charged by law to give full consideration to all beneficial uses of water, including recreation, fish and wildlife uses, considered the application and also made a study of the river basin.

By order of the board, the upper portion of the river was withdrawn from appropriation except for domestic uses, and the waters classified for recreation, fish and wildlife purposes, permitting however, the impoundment and use of the water at a certain location for hydropower provided proper consideration was given to protection of fish and recreational uses of the impounded water.

On January 8, 1959, the Federal Power Commission issued the license for the hydro project with a complete recognition of public uses of the water and acceptance of the wishes of the State agencies.[11]

In actual procedure, the State of Oregon intervened in the hearing before the Federal Power Commission and urged the granting of the license, subject to the conditions which the Commission proceeded to adopt and included in the license.

There has been an acceleration of filing under State laws for water rights to springs, seeps, swamps, natural lakes, etc., located on Federal lands. Most such waters are essential to wildlife uses. Ownership of the water by an individual may deny the public rights of recreation, fish, wildlife, scenic attraction, and make the use of the public domain subject to the will of the owner of the water right. Control of the water would give control of the public domain, for it would have no use except to the owner of the water.

If Federal law controls such waters, they are either not subject to appropriation or can only be appropriated by consent of the United States.

This situation is acute in Arizona. Under State law by a simple method of marking an X on a map, a stockman can file on waters on public lands. Some 1,500 have been filed since 1956. Arizona Game and Fish Department have protested many of these claims as against public interest. The State Water Commission rejected the protests.

The Forest Service filed claims to approximately 600 springs and seeps for livestock use. The State commissioner refused most of the filings.

If Federal water law applies to these Federal lands, such waters are not subject to appropriation and can be held a part of the public domain for the many multiple uses, including recreation, fish and wildlife uses.

This position has been taken by the Secretary of Agriculture's announcement of April 9, 1959, in the Federal Register, "Water rights obtained under State law on such lands (U.S. forest lands) will not be recognized as giving the recipient thereof any right to use such lands in connection therewith or to enjoy the benefits thereof."

While this may not be an outright denial of the State water rights, the effect is the same.

CONCLUSIONS

A. Administration and application of water law should be a function of State government as to waters within its boundaries.

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[11] Art. 34. The licensee shall comply in all respects with the aforementioned resolution of the State Water Resources Board of Oregon, dated July 17, 1958, which resolution, embodying a program for development of the water resources of the McKenzie River from Clear Lake downstream to river mile 86.9 (below the mouth of Smith River and Bunchgrass Creek), is approved and adopted as the Federal Power Commission's own determination in the matter, and the licensee shall construct, operate and maintain the project in accordance with the provisions of the resolution subject to further order of the Federal Power Commission.

Art. 35. The aforementioned agreement between the licensee and the State of Oregon, acting by and through the Oregon State Game Commission and the Fish Commission of Oregon, dated Aug. 1, 1958, for the protection of fish life, is approved and adopted as the Federal Power Commission's own determination in the matter, and the licensee shall operate and maintain the project in accordance with the provisions of the agreement subject to further order of the Federal Power Commission.

Art. 36. The licensee shall construct, operate, and maintain such protective devices and comply with such reasonable modification in project structure and operation in the interest of fish and wildlife resources as may be prescribed hereafter by the Commission upon the recommendation of the Secretary of the Interior, and the Fish and Game Commissions of the State of Oregon.

B. With only one, possibly two, exceptions, water laws of the Western States are unfavorable to public uses of water (recreation, fish, wildlife, pollution abatement, and scenic attraction).

C. Sovereignty over the waters of the public lands of the United States should be given, or restored, to the States only on the condition that their State laws recognize and give equal status to water for all beneficial uses, except domestic and livestock, which should enjoy priority. Such beneficial uses must include the rights of the public to water for pollution abatement, recreation, fish and wildlife, and scenic beauty. These public rights must be protected by some device equal in effect to that of appropriations for other uses.

Mr. ARRINGTON. In his paper, Mr. Binford points out that, under western water law concept, all waters are subject to appropriation for specific uses, usually with priority given to irrigation and livestock watering, and that to perfect such appropriation the water must be diverted or subjected to some physical act. The ownership of the land on which the water arises, or though which it passes, does not grant such landowner any right to water use. Thus western water laws provide for the appropriation of all waters on all of the public lands of the West without any regard for the public use of these lands.

From his studies Mr. Binford states that in the West:

* * * fish and wildlife uses are dependent on the leavings of water.

With only one, possibly two, exceptions, water laws of the Western States are unfavorable to public uses (recreation, fish, wildlife, pollution abatement, scenic attraction).

In several States constitutional changes would have to be made to give fish and wildlife uses equal status with present preferred uses.

* * * only a few (Western States) are likely to give recreation, fish and wildlife equal status with other uses, as their legislatures are mostly dominated by the agriculturists and stockmen.

There has been an acceleration of filing under State laws for water rights to springs, seeps, swamps, natural lakes, etc., located on Federal lands. Most such waters are essential to wildlife uses. Ownership of the water by an individual may deny the public rights of recreation, fish, wildlife, scenic attraction, and make the use of the public domain subject to the will of the owner of the water right. Control of the water would give control of the public domain, for it would have no use except to the owner of the water.

* * * there clearly can be no multiple use, comprehensive development of water resource which would give consideration to all beneficial uses, including fish and wildlife.

In Arizona it has been ruled that neither the U.S. Forest Service nor the Bureau of Land Management can file on water on Federal land for livestock, wildlife or anything other than administrative or domestic use, and then only when the waters are to be developed immediately. No reservations for future needs can be made.

The Secretary of Agriculture announced in the Federal Register on April 9, 1959, the following revision in Forest Service grazing permit regulations:

Water rights obtained under State law on such lands will not be recognized as giving the recipient thereof any right to use such lands in connection therewith or to enjoy the benefits thereof.

Undoubtedly this is about the best the Department could do at this time, but we do not believe anyone will contend that it solves permanently the problem of future use of water on public land for fish, wildlife and recreational purposes.

In Arizona our Department has occasionally filed for water for a fishing lake and recreational facility to be developed on Forest Service land. Seldom has one been over 50 surface acres in size. Water is asked for first filling and evaporation losses. Almost invariably

protests are made by downstream water users, some 20 to 50 miles down a streambed which carries no water except at flood times. Possibly the protester wants to irrigate a small plot of submarginal cropland, possibly permit the water to spread out over grassland to make more livestock feed.

Some protesters have been Forest Service permittees who stated their major objection was not to the use of water for the lake but to the people who would come onto and use the Federal land around the lake and be a bother to them.

Such protests are entirely in order under present western water law concepts. Therefore, water arising on public land cannot be put to beneficial use for recreational purposes, although it is drastically needed by the public who owns the land, and the economy of the area and the State would be benefited by such use.

It is generally accepted, and it has been upheld in Federal courts, that when Indian reservations were established, there was reserved to the Indian tribes the water presently needed for their reservations and also water which they might reasonably need in the future. Should not the public who owns the public lands be given some comparable consideration for the public need on those lands?

We are attaching for inclusion in the record a recent resolution of the International Association of Game, Fish, and Conservation Commissioners relative to the problem of water use on public lands.

(The information referred to follows:)

RESOLUTION BY THE INTERNATIONAL ASSOCIATION OF GAME, FISH, AND CONSERVATION COMMISSIONERS AT CLEARWATER, FLA., SEPTEMBER 15, 1959

Whereas the demand for water by the exploding human population for industrial, agricultural, and other uses is increasing rapidly; and

Whereas the need for recreation and the attendant use of water is absolutely necessary to preserve the health and welfare of the people of the United States; and

Whereas there is pending in the Congress certain legislation that would give control of waters originating in public lands to the States without regard to the public right to use these waters; and

Whereas most State laws do not give adequate recognition to the use of water for recreation including fish and wildlife purposes: Now, therefore, be it

Resolved, That the International Association of Game, Fish, and Conservation Commissioners urges the Congress that any such legislation contain provision recognizing wildlife and recreation as a beneficial use of water and to safeguard the interest of the people in the use of water originating on public lands for recreation and fish and wildlife purposes.

Mr. ARRINGTON. It has been calculated that there are 48 million acres of publicly owned land that can be considered of value for recreational purposes. We submit that Congress cannot, in the public interest, grant to the State sovereignty over the waters of the public lands without reserving as beneficial uses the rights of the public to water for recreation, fish and wildlife, and pollution abatement, now and in the future. These public rights must be protected by statutory provisions equal in effect to those of appropriations for other uses.

We are fully aware of pressures which will arise throughout the West against such provisions in any congressional act. It required great congressional fortitude and inspirational leadership at the turn of the century to enact laws which prevented the stripping of the great timber and forage resources from the public lands of the West,

thus permitting the best management, in the national interest, of these essential renewable resources and the watersheds on which they depend.

We are convinced that congressional delegates of today will exercise the same diligence and fortitude in providing for future generations proper multiple-use management of our most important and increasingly critical natural resource—water.

The social impacts of our exploding population, coupled with more leisure time, longer life and greater mobility, makes it imperative that multiple use be made of our remaining water resources with full consideration for future fish, wildlife, and recreational requirements.

Although the tangible dollar is the least of the major benefits to be derived in the future from the use of water for recreational purposes, statistically sound surveys show that Arizona fishing license holders spend in pursuit of their sport over $1,000 annually for every surface acre of water within the State available to them.

Arizona and the Southwest, where water is scarce and populations are booming, provides a laboratory where the future necessity of the multiple-use concept of water resource use can best be analyzed. Here Congress can find much of value on which to project its thinking into the future for constructive water resource development legislation.

Legislation suggestions for congressional consideration:

1. Provision for fish, wildlife, and recreational use of water in all Federal agency water construction projects.

The recently enacted amendments to the Fish and Wildlife Coordination Act, Public Law 85–624, should be strengthened by proposed legislation which will permit more adequate public recreation, fish, and wildlife, facilities at Federal water construction projects.

Provision should be made for water for a small permanent impoundment for fish, wildlife, and recreational use as a requisite in connection with all Federal flood control and water development projects if such impoundment is feasible from an engineering standpoint.

Water created by Federal drainage channelization and vegetation eradication projects should be considered as new water and a portion thus created with expenditures of tax funds should be made available for fish, wildlife, and recreational purposes.

2. Recognition of the necessity of water in the future management and public use of Federal lands in any western water-right settlement legislation.

We concur in the need for some type of legislation which will clearly define and specify the extent of Federal interest in water resources within State boundaries.

In considering such legislation Congress should carefully analyze existing obsolete western State water laws and their usual complete lack of provision for the multiple use of water, particularly in relation to the exploding public needs and demands for fish, wildlife, and recreation use.

Congress cannot, in the public interest, grant to the individual States complete sovereignty over the waters arising on 48 million acres of public lands considered suitable for recreational pursuits without reserving as beneficial uses the rights of the public to water

for fish, wildlife, recreation, and pollution abatement, now and in the future.

It required great congressional fortitude and inspirational leadership at the turn of the century to enact laws which prevented the stripping of the timber and forage resources from the public lands, thus devastating the watersheds on which they depend.

Congress today must, and we are certain will, exercise the same diligence and fortitude in providing for the proper, multiple-use management for future generations of the most important and increasingly critical renewable natural resource—water.

We thank you.

Senator ANDERSON. Thank you.

Mr. Fox, will you state your name and organization that you represent.

STATEMENT OF KEL M. FOX, SECRETARY, ARIZONA WATER RESOURCES COMMISSION

Mr. Fox. Mr. Chairman, I represent the Arizona Water Resources Commission.

By the way, Mr. Chairman, I had the pleasure of working with the distinguished junior Senator from New Mexico a good many years ago on the Coronado Centennial Commission.

Do you recall it?

Senator ANDERSON. I not only recall it, but I was moving into a new office the other day and having to transfer files, came across some of the pictures we made when we were down dedicating the Coronado Monument when we had a meeting in Arizona, and found samples of the street decorations they used; and since they had been packed away for 20 years, I decided to send them to the laundry and have them cleaned.

The CHAIRMAN. When was the last time you and the junior Senator saw Coronado?

Mr. FOX. I would rather the junior Senator answer that.

Senator ANDERSON. I remember him very well. He was here and we had a nice time.

The CHAIRMAN. I know he came through Oklahoma on his way here and I thought maybe you boys had seen him since I had.

Senator ANDERSON. He went to Oklahoma on his way back here.

The CHAIRMAN. By the way, Senator, I think it might be well to ask our staff director to stand and be recognized—Mr. Ted Schad—and let him have a minute to present the other members of our staff, because actually their work in connection with the compilation of the information obtained is going to be of such vital importance that I would like for the people here in Albuquerque to see them.

Mr. SCHAD. Thank you, Senator. We are very fortunate, as the chairman has mentioned, in having some very capable people to work on this committee. Dr. Edward Ackerman, on my left, has had a long career of work in the water resources field with the Tennessee Valley Authority, with the Bureau of the Budget, and with the University of Chicago; and he has had other connections. He is one of the consultants to the committee.

Dr. Ackerman.

I know many of you have worked with the Geological Survey records. You have seen the name of this next gentleman many times on the Geological Survey publications, and he has written several books since his retirement—Mr. W. G. Hoyt, another consultant.

Serving as chief clerk of the committee, we have Mr. Paul McBride, and we have had loaned to us one of the experts from the Public Works Committee staff, Mr. John Mutz. And Senator Anderson has let us use Mr. Doyle Kline to help with arrangements for these meetings.

We also have one of the men from the Interior and Insular Affairs Committee staff, Mr. Gene Eaton, assigned to work with us. Senator McGee has sent one of his assistants, Chuck Whittemore, along with us to help out. And Senator Hart of Michigan has sent Muriel Ferris to work with us.

Senator Kerr has assigned one of his secretaries to work with the committee, Peggy McCormick. I do not think she is here. She is probably back in the hotel working.

I also want to call attention to our reporter, Mr. Frank Smonskey, from the Alderson Reporting Co., of Washington, D.C., who takes it all down and has been known to go as long as 8 hours without leaving his chair.

The CHAIRMAN. Thank you, Mr. Schad.

Senator ANDERSON. Could I just say that apparently what Senator Kerr did has a precedent?

There is a little verse that goes:

When Homer smote his blooming lyre, he heard men sing by land and sea, what he thought he might require he went and took the same as me.

That is what Bob Kerr did when he found the people around the Capitol, he went and took them. I think it is appropriate to say for John Mutz, we had him here in reclamation work for many, many years and John has had a strong and vital interest in water resources in this area.

As to Dr. Ackerman, I want to say I was in a special panel one night in Washington in which there was a principal speaker and two sort of lesser lights. Dr. Ackerman and I were the lesser lights and his paper was by long odds, it seems to me, the most important of the evening. From that day on I steadily recommended him to people who want to make contact with a brilliant mind.

I am very happy that Dr. Ackerman was kind enough not only to come to the committee but also to come to New Mexico.

Thank you, Senator Kerr, for suggesting that we might present the members of the staff.

Go right ahead, now, Mr. Fox.

Mr. Fox. Before I read this statement, I would like to thank the Senators on behalf of myself and my colleagues to permit us to speak early in the program. It is a long way home.

Mr. Chairman, my name is Kel M. Fox. I live in Sedona, ARIZ.

I am representing the Arizona Water Resources Committee, a private nonprofit citizen's group which sponsors a unique plan of water conservation known as the Arizona watershed program.

You have heard—and will hear—reams of statistics about the growing shortage of water, for people, for industry, for agriculture. You

have heard—and will hear—many plans for increasing the available supply of water, most of them expensive.

I am going to dispense with the statistics and limit my discussion to one suggestion—mainly, that water can be increased by reducing evapo-transpiration.

Evapo-transpiration. What does it mean? Evaporation may be loosely defined as the loss of moisture by heat action; transpiration as the loss of moisture by plant growth. Put the two together and you have the biggest cause of water loss in the Southwest.

It is estimated, for example, that of the some 80 million acre-feet of water that falls annually on Arizona in the form of rain or snow, less than 10 percent is recovered for man's use. The other 90 percent plus is evaporated into the air or transpired by plants.

It is obvious if this loss could be cut just 10 percent, my State would have almost twice as much water for its growing population, its expanding industry, and its thirsty farmlands.

And that is precisely the objectives of what we call the Arizona watershed program.

No one, to the best of my knowledge, has come up with a plan to stop evaporation. But numerous scientists, many of them of national repute, have advanced theories on how transpiration losses may be reduced. It is on these theories that our program is based.

It has long been known, for example, that deep-rooted plants, such as trees and shrubs, generally consume more water than shallow-rooted plants, such as grasses. It would follow, therefore, that an acre of grass would consume less water than an acre in trees or shrubs.

We are making exhaustive tests to see if this theory holds true.

In most of the so-called Western States, the mountain highlands are the prime source of water. Most of these highlands are located in national forests. It was essential, therefore, that we interest the U.S. Forest Service, the custodian of these lands, in our program.

We have done so. The forest Service is an enthusiastic cooperator in our aims and objectives. Important research projects are now located on four of the national forests of Arizona. One of these will determine if cutting spruce, fir, and mixed ponderosa pine in blocks and patches will produce more water than harvesting such timber by the present selective cutting methods.

Another project will measure the increase, if any, when all the ponderosa pine is removed from a poor-growing site and the area planted—and maintained—in grass.

It is typical of the pine forests that there is too dense a growth of young trees. The Forest Service is keen therefore about the suggestion that these dense stands be thinned. Water produced from the areas where the trees are thinned will be measured against that produced from untested areas to see if there is an increase.

We have a number of projects to measure the effect of juniper removal on water yield.

Elsewhere experts are converting bushland to grassland and measuring the results in terms of water.

In still another part of Arizona, cottonwood and sycamore trees, which frequently clog our streambeds and, we know, consume a lot of water, are being removed to see what effect this treatment has on the streamflow.

This is no small program, as can be seen from this brief description of some of the work in progress. It involves well over 100 complicated, and expensive, gaging devices to measure the water produced on treated areas as against the water produced on untreated areas. Projects are located in 8 of our 14 counties.

Agencies cooperating in the program, in addition to the Forest Service, include: the Agricultural Research Service; U.S. Geological Survey; Bureau of Indian Affairs; Soil Conservation Service; State land department; University of Arizona; State college at Flagstaff; Salt River project which is an irrigation and power district; various Indian tribes and private groups, such as the Charles Lathrop Pack Forestry Foundation.

The program has the active support of our delegation in Congress, one of the earliest exponents being your esteemed colleague, Carl Hayden.

Since it involves the potential treatment of millions of acres of public or Indian-owned lands, the bulk of the money for research comes from congressional appropriations, now running around $500,000 a year. Our State legislature also makes annual appropriations for watershed research, as does the Salt River project.

Where is all this leading? Some experts, such as Dr. Harold G. Wilm, former Chief of Watershed Research for the Forest Service and currently New York State conservation commissioner, believe we can save as much as 245,000 acre-feet. According to my figures that runs into trillions of gallons of water, that we can save 285,000 acre-feet of water a year from our Salt and Verde watershed alone, about 10 percent of the land area of the State.

That is about four times as much water as is used each year by our largest city—Phoenix—or about 2½ times as much water as is used by Denver, Colo., a city which is spending some $150 million to firm up its water supply. Some estimates—and they can be only estimates, at this point—are that the conversion process would cost only about one-third as much as Denver is spending and would recover 2½ times as much water.

There would be "side benefits" too. I have touched briefly, for example, on the willingness of the Forest Service to thin dense stands of saplings—for the obvious purpose of making the remaining trees grow faster. More grass will increase State and Federal income from grazing. A cleaner forest will be more readily accessible to sportsmen and campers and less susceptible to devastating wildfire losses.

Can transpiration losses be reduced? We believe they can. The Arizona watershed program will provide the answer—an answer being watched by experts in many States and several foreign countries. It's an answer that can mean much to every State in the Union.

Thank you.

Senator ANDERSON. Thank you, Mr. Fox.

Has there been a problem resulting from the growth of phreatophytes down in the Salt River Valley? Is that as serious as it is in the lower mid-Rio Grande Valley? It is in New Mexico. Are you having any trouble with it?

Mr. Fox. I would not say our problem is quite as serious as yours, Senator, but we do have one and we are working on it.

Senator ANDERSON. This is a good statement, Mr. Fox, and we appreciate it very much.

Mr. Fox. Thank you, sir.

Senator ANDERSON. There were at least two representatives from Texas here. They do not plan to testify, I believe. I wonder if you would not just come forward and state your name for the record so we might know we had some Texas friends here? Would you do that, please?

The CHAIRMAN. Unless they are too timid, Senator.

Senator ANDERSON. There are three, no, four—and I promise you no Texan is timid. It is like the motto of New Mexico—it grows as it goes.

Would you briefly introduce yourselves and make any statements you desire? Who is the ringleader?

Mr. WYATT. There's no ringleader.

Mr. RAYNER. I am Frank Rayner from the Texas State Board of Water Engineers, and I am here at the request of Judge Dent, who, unfortunately, could not make this meeting due to a prior commitment.

Mr. WYATT. I am Wayne Wyatt, with the High Plains Board Water District.

This is Roy McQuattera, who is one of our directors, and Arthur Duggan who is a lawyer who helps us in our legal work.

Senator ANDERSON. Thank you very much. We are very happy that you gentlemen from Texas came here. We hope that you profit from this hearing. If you have ideas you would like to have become part of the record of this hearing, submit them and Senator Kerr and staff will be happy to receive them.

Thank you very much.

Mr. WYATT. Thank you, sir.

Senator ANDERSON. Congressman Morris expected to be here with us here this morning and to submit a statement to the committee. However, because of transportation problems he will be unable to arrive until later on in the day. Therefore, at this point I would like to include his statement in the record.

(The statement referred to follows:)

STATEMENT OF HON. THOMAS G. MORRIS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW MEXICO

Mr. Chairman, I would like to present a statement concerning the water-related problems of New Mexico and the Southwest for your consideration containing three elements. They are: (1) correction of an oversight resulting from previous legislation regarding the health of American Indians; (2) recommendations for including in Federal law certain provisions for the authority of the States with respect to the control and use of water within their boundaries; and (3) some of the more crucial water resource problems of the State of New Mexico and its neighboring States.

HEALTH OF AMERICAN INDIANS

The low economic status of the Indian and their disadvantageous environmental conditions are acknowledged to be holding back their progress. Much can and should be done toward improving health conditions. Sanitation is wholly inadequate. It is necessary that legislation be sought to create an atmosphere where responsibility is definitely placed and an immediate program of improvement undertaken.

Indians are Americans and are entitled to this much, at least. Programs should be inaugurated at once on all phases of sanitation, water supply, and irrigation facilities.

Statistical data on the present deplorable conditions are readily available and I urge this committee to give the utmost consideration to seeking a solution to the problems of improving the health environment and economic status of the American Indian.

STATE WATER RIGHTS

As most of the members of this committee are aware, we westerners are very much concerned over our water resources. We are even more concerned in view of the deeply disturbing developments in recent court decisions and Federal legislation affecting the whole area of water resources.

As water is so vital to our very existence any action affecting our rules with respect to how much use is to be made of what water, when and where, is scrutinized minutely. It is with a great deal of alarm that we note this scrutiny in recent years has revealed an increasing degree of encroachment upon and the ignoring of our State water laws by court decisions and Federal Government activity.

Over the years the States, Western States especially, have built up a system of water laws which have proved to be equitable. They offer opportunities for the creation of property rights for beneficial use of public water supplies. These State water laws provide protection for investment in water use facilities. They provide a basis for evaluation of the risk and worth of developing public or private water supplies in advance of commitments. The burden to water shortages may be shared equitably under State water laws. These laws are uniquely adapted to changing local conditions of water supplies and needs. We have worked with them and lived with them a long time and they have become a part of the western way of life.

The historical and practical development of water-use principles and relationships embodied in these statutes had their roots in local water shortages or distribution problems. They were accepted and enacted into law by Federal Territorial governments and were continued in effect when statehood was attained.

These principles, with some alteration to meet more involved situations, have met the test of time, or so we believed, even with the growing volume of Federal water development activities, until recent years.

Several twilight areas exist, such as those involving water resources serving Indian reservations in whole or in part, or originating therein and how to cope with claims to water rights based on common law riparian rights.

Another point or controversy of uncertainty is provided by the growing number of interstate water compacts. Although approved by the Congress, they contain some contradictory provisions.

I hope that the committee will study this problem and recommend a uniform recognition of the primary status of State water laws. The existing Federal-State jurisdictional dispute over water-use administration must be settled.

I think that all who are actively involved in water-resource development will agree on insisting that the solution to this problem should contain the following provisions:

1. Public water supplies, irrespective of origin, should be available for use by all.
2. Valid rights in water should be recognized and protected in the planning, construction, and operation of water-resource developments.
3. Such rights should not be usurped without just compensation.
4. New uses of water should be limited to presently unused portions of the water supply as supplemented by lawfully acquired existing rights.
5. Unappropriated water supplies available for new uses should be determined in accordance with State records of valid water rights.
6. New water rights should be acquired through procedures prescribed by State water laws and, upon acquisition, the record of such rights would take their proper place in State records as a basis for further determinations as to unappropriated water.

This, I believe, would bring order out of the present chaos, and would not involve placing Federal activities under State supervision, but would recognize and give status to present rights under State law, and affect all water rights equally.

The Rio Grande and its principal tributary, the Pecos River, drain about two-thirds of the State. Essentially all of the New Mexico share has been committed. The most pressing problem remaining in this basin is flood control and

water conservation through channel improvements. When current projects designed to accomplish these aims are completed, New Mexico's best hope for continued economic growth lies in putting its share of the water of the Colorado River to work.

The Colorado River storage project for the development of the Upper Colorado River and to enable the upper basin States to meet their commitments under the Colorado River compact of water to the lower basin is vitally necessary to the future advancement of the affected areas. Construction of the participating projects are required as a prelude to meeting full industrial and agricultural needs of western New Mexico.

It would be almost impossible to overstress the importance of rapid completion of the major projects now underway. Storage projects, of course, are the prime requisite for development. Once these projects are completed, the detailed planning for participating projects should be completed without delay. Two such projects of the greatest importance to New Mexico are the Navajo Indian irrigation project and the San Juan-Chama project.

Early development of the water resources of the San Juan River, a tributary of the Colorado, is urgently needed. This would include the San Juan-Chama and Navajo irrigation projects. A coordinated report on the San Juan River project has been completed but has not yet reached the Congress. The Navajo irrigation project has been approved by the Senate only this past session and early House action is desirable.

There are serious flood problems in the basin, particularly in the Animas River portion. Studies now underway by a number of agencies, the Corps of Engineers, Bureau of Reclamation, other Interior Department agencies as well as the State agencies, should be accelerated. Navajo Dam and Reservoir are fundamental parts of the development of this basin and should be prosecuted, with all possible speed. It will be the basis for the Navajo irrigation project which I cannot urge too strongly as being of the utmost importance to the Navajo Indians. The San Juan River development is needed further for future municipal and industrial uses.

This development, including the Abiquiu Reservoir, is vitally necessary to the future development of central New Mexico, including Albuquerque.

The so-called Middle Rio Grande Basin is plagued by flood, sediment, and drainage problems as well as loss of a great deal of water to beneficial use because of nonbeneficial plants which grow on sediment deposits and use a great deal of water which is lost irrevocably. Levees and other works, some authorized as long ago as 1948, have been initial elements in an attack on these problems but much remains to be done.

As developed by current Corps of Engineers studies, I urge prompt authorization and prosecution of the proposed Cochiti and Galisteo Dams. They are vitally needed to cope with flood and sediment problems. New Mexico, Texas, and Colorado are in agreement as to operating details for these dams. Completion of these projects will salvage up 200,000 acre-feet of water now being lost to beneficial use and provide vital flood protection while lessening the sediment problem.

Evaporation and transpiration losses in this area are great. New Mexico's State agencies have expressed willingness to cooperate in every way with the vigorous prosecution of studies into means of coping with this problem which plagues the entire Southwest and most of the arid section of the Nation.

The Pecos River compact, approved by the Congress, has allocated the full amount of water which can be used beneficially, as between Texas and New Mexico. The remaining problems are siltation of existing reservoirs and the river channel, salinity, flood control, and, again, evaporation and transpiration losses.

Los Esteros Dam, proposed to be constructed above Santa Rose by the Corps of Engineers, would provide flood control and conservation storage to replace storage capacity lost in the Alamogordo Reservoir due to siltation. It is believed the latter will be completely lost within 40 years.

Some means of coping with the salinity problem in the Pecos River at Malaga Bend must be developed. Corrective works called the McMillan Delta water salvage project, would salvage an estimated 24,000 acre-feet annually. Early completion of these projects is desirable.

The Bureau of Reclamation has proposed storage facilities at Brantley Dam, just downstream from McMillan Dam for 297,000 acre-feet of storage. This would provide sediment control, flood prevention while providing conservation storage for the Carlsbad irrigation district. Recreation and fish and wildlife

propagation would also be major beneficiaries of the Brantley Dam. The Bureau also is developing a comprehensive plan for water salvage in the reach of the Pecos River from Alamogordo Reservoir to Carlsbad. Preliminary estimates are that 75,000 acre-feet can be saved which is now lost. Unless some action is taken it estimates that nonbeneficial use loss will increase in the next 50 years to over 300,000 acre-feet annually. I urge that this proposal be given the utmost consideration.

The Bureau also discusses the possibility of rehabilitation of a number of small community projects in this area which are unable to maintain themselves. This bears looking into in detail.

Hydroelectric-power potentials in the Pecos Gorge section should be closely examined. Power generation and sales could be useful in repayment of Federal construction costs in the Pecos Basin.

The Gila River Basin development is tied in with the *Arizona* v. *California* suit—the Long suit—now before the Supreme Court. New Mexico, as one of the Lower Colorado River Basin States, is vitally concerned. It is urged, in the event a decision is rendered in favor of the plaintiffs, that full advantage be taken of the increased utilization made possible. In that event 56,700 acre-feet of additional water would accrue to New Mexico. Federal cooperation will be needed by the State in order to utilize this amount to best advantage and so as not to affect adversely other projects in the general area.

The State is proceeding through the New Mexico Interstate Stream Commission to develop plans for storage facilities for its share of the waters of the Canadian River system near the Texas boundary line. It is urged that Federal contribution to the costs of this dam are justified in recognition of flood and sediment control, recreation, and fish and wildlife benefits, which would be considerable.

New Mexico has increased its reliance upon ground water for irrigation to the extent of 300 percent between 1940 and 1955. It serves now to irrigate well over 600,000 acres and supplies over 90 percent of municipal and industrial purposes. Such a further increase in the future will not be possible, as it is believed all or most of the large supplies of ground water in the State have been located and measured.

The State exercises, under State law, control over ground water, and may limit withdrawals, new drilling, or even close down within specific areas.

In many sections, withdrawals far exceed the annual recharge. Withdrawals are being made from underground reservoirs which are considerable in extent and volume.

The Roswell Artesian Basin, in the lowland basin of southeastern New Mexico, has been a prolific source of irrigation water for 60,000 acres, due to its recharge from the highlands. Total perennial supply has been estimated at 200,000 acre-feet a year, but close control must be exercised to prevent waste. This is being undertaken by the State. Little additional development is possible from this source. The policy of the State is to limit withdrawals to that which can be maintained long enough to liquidate the repayment of development costs—usually 40 years.

It is probable that the originally estimated 27 million acre-feet in underground storage in southeastern New Mexico will be so exhausted in the next 20 years as not to be economically feasible for use for agricultural purposes, but will still be sufficient for domestic use and for industry for many years. Brackish waters and brines may be used to supplement ground water supplies as soon as economic methods are developed.

In many of the basins, in the State where ground waters are closely related to surface water, the practice of using ground water to supplement surface-water supplies has been adopted, notably in the Carlsbad, Virden Valley, Hondo, Bluewater, and Rio Grande Basins. The New Mexico Interstate Stream Commission and the Bureau of Reclamation are studying the possibility of developing such supplies for the rejuvenation and rehabilitation of numerous small irrigation projects. Specific authority by legislation may be required for Federal aid to be extended in these instances. This is potentially a growing field of endeavor for the Bureau of Reclamation in many portions of the West and I urge a detailed study of its possibilities.

A prime necessity for any program of water resource development is complete basic data. This is sadly missing in many areas of the Nation. It is regrettable that, where water is of such vital importance, the West, and most particularly the Southwest, there remain many gaps in such data. I urge strongly that the Federal and State Government cooperate in a vastly accel-

erated program seeking a complete inventory of all water resources ground and surface.

As concurrent programs there is a great need for further study of evaporation and transpiration problems and a search for countermeasures; for topographical cedastral and geological mapping (nearly two-thirds of the State has not been satisfactorily mapped); intensive research into vegetational management to eliminate useless, but water-consuming plants; and above all, a program for the conservation of water. Included in the latter is the Soil Conservation Service watershed protection program. It is desired that eventually, certainly within the next 40 years, this program will include all small watersheds and be operated in close harmony with the programs of the Bureau of Reclamation, Corps of Engineers, and those of State and local governments as well as private interests. There is need for the closest coordination and cooperation as the availability of water becomes relatively more and more restricted.

Some of the saline surface water is man created by means of return flow to streams from irrigation. Use of water for irrigation increases its mineral content because of losses of fresh water by evaporation and transpiration. Successive use of water from the same original source makes downstream surface water supplies highly saline.

Municipal and industrial wastes including oilfield waste also increase salinity of surface waters.

Volume of flow, of course, tends to lessen the salinity; however, in many cases, the periods of highest salinity generally follow periods of high flow and coincide with periods of greatest consumption.

An interesting phenomenon in this connection has been noted—that where man has regulated the flow of streams by impoundment there is a smoothing out of the daily variation in salinity of water passing downstream. This has been observed on the Pecos River above and below Alamogordo Dam in New Mexico.

Some of the Arkansas River tributaries, including the Cimarron and Canadian Rivers, are relatively saline. The Cimarron River is fed by salt springs and seepage from underlying salt beds in the upper reaches and in the lower reaches by natural salt beds and oilfield brines. The north Canadian River has been reported as quite salty, too salty for general use. The Canadian River is subject to periods of high salinity. Highly soluble rock formations create saline runoff in the Red River Basin. Low flows of the Salt Fork of the Brazos River are often very saline although highly variable. The Pecos River drainage basin of over 44,000 square miles has several salinity problems. Below Alamogordo Dam water is slightly saline. From Roswell, N. Mex. to the Red Bluff Reservoir in Texas inflow from springs and irrigation return flow increase the degree of salinity. On occasion it has been recorded at eight times the salinity of sea water where the flow from the spring enters the stream. The available water supply of the Pecos watershed is so limited that further industrial development is largely inhibited and irrigation is difficult and complicated. The Rio Grande is also affected by salinity.

The upper basin tributaries of the Colorado River carry substantial salt concentrations, particularly in runoff from exposed shale beds. This is most pronounced in the Utah portions of the basin.

In the Lower Colorado River Basin, demands exceed available resources. A major tributary—the Little Colorado River—is extremely erratic in its pattern of flow. Following its frequent but heavy periods of rainfall, its waters are very salty. Increased storage capacity in this sub-basin is essential.

Throughout the lower basin the quality of water deteriorates as it progresses downstream. Mineral springs contribute to this problem.

Saline water resulting from solution of salt from the aquifer of adjacent rocks are found in much of the region extending from north central Texas to southeastern Nebraska and the Trans-Pecos region of western Texas and eastern New Mexico.

In many of the arid and semiarid basins of the Southwestern States much of the ground-water discharge is by evaporation from dry lakes and transpiration by water-using plants. Where these occur, the dissolved minerals in ground water become greatly concentrated as the residual salts accumulate.

The great plains, the southern tip of which includes the High Plains of western Texas and Oklahoma and eastern New Mexico, is a region in which water supply may be described as deficient in quantity and low in quality.

Locally water has become more highly mineralized because of heavy pumping from the Ogallala formation and consequent penetration by highly saline water from other formations. This is the major source of water supplies for all uses.

In the Trans-Pecos area water from limestone formations are relied upon for irrigation although it is moderately saline, particularly in the Roswell artesian well area of southeastern New Mexico.

Northwestern New Mexico and northern Arizona and the region extending north, referred to by geologists as the Montana-Arizona Plateau yields only meager supplies of ground water, most often saline. This is true of the area often referred to as the Four Corners.

Most of the rest of the Southwest, including Nevada, western Utah, Arizona, New Mexico, southern California, and the Upper Rio Grande Valley of Texas depend heavily upon alluvial sand and gravel deposits in closed basins and along major streams for much of their water supply. The water is apt to be fairly plentiful but moderately saline. In the southern portions of this area saline water is used extensively for irrigation.

SUMMARY

There are large resources of water in the Southwest which for various reasons are not suited for general use. Much of industrial water supply demand is for relatively pure water with a minimum of minerals. As much of the available water of the area is committed to domestic and irrigation use, industry is handicapped, its growth and expansion inhibited throughout most of the Southwest.

Utilization of saline or brackish water made possible by development of economic methods of processing is essential if the Southwest is to grow with the rest of the Nation. Much of the salinity found in this area is peculiar to it, and intensive research and development within the area is a minimum requirement. I urge immediate and concentrated effort in this direction. I hope this committee will so recommend.

Multiple-purpose development of all the water resources of the Southwest which includes New Mexico, Arizona, Nevada, Utah, and western Texas, is an absolute necessity to a region where water is scarce most of the year and where natural replenishment is slow and undependable, while at the same time the quality of much of the water resource is low.

It is a known fact that water storage tends to reduce the fluctuations in salinity of surface water. Conservation is dependent upon storage and such collateral benefits as recreation, power, fish and wildlife conservation are all dependent upon stored waters.

As I see them, the water-related problems of the Southwest, and especially those of New Mexico, consist of a pressing need for the construction of storage facilities, detailed planning of participating projects, accelerated programs of mapping, and collection of basic data, developments of desalinization methods for utilization of saline and brackish waters, evapotranspiration, sediment and nonbeneficial vegetation control or elimination, watershed protection, flood control, improvement of the health and economic status of the American Indian, and recognition of the status of State water rights laws.

Solutions to many of these problems can be expedited by making increased funds available to the Federal factfinding agencies. Close cooperation and coordination of the activities of all agencies is required to attain the optimum use of the water resources of the Southwest.

Thank you for your courtesy.

Senator ANDERSON. Next is S. E. Reynolds, State engineer of New Mexico.

STATEMENT OF S. E. REYNOLDS, STATE ENGINEER AND SECRETARY, INTERSTATE STREAM COMMISSION, STATE OF NEW MEXICO

Mr. REYNOLDS. My name is S. E. Reynolds. I am State engineer and secretary of the Interstate Stream Commission of the State of New Mexico. In response to Senator Kerr's request of June 23, 1959, the State of New Mexico has already submitted a written report to this committee.

With your permission I will summarize that statement in this oral presentation. With the hope of assisting you in following the testi-

mony that will be given today I have placed on the bench several additional copies of the New Mexico report and enlarged copies of the map that appears in the report.

The CHAIRMAN. I want to thank you for the committee for the submission not only of the previous statement but for this very comprehensive compilation of information here and to tell you how much we appreciate it.

Mr. REYNOLDS. Thank you, Senator.

New Mexico is party to seven interstate stream compacts. All of New Mexico's significant surface streams are now subject to such agreements. When New Mexico has fully developed her surface-water resources within the limits of those compacts, the deliveries into the State under the compacts—principally from Colorado and the Rio Grande and the San Juan River—will approximately equal the outflow.

The CHAIRMAN. Does this statement disclose the amount of that outflow?

Mr. REYNOLDS. Yes, sir. If I may I will summarize that.

The CHAIRMAN. Have you a general figure?

Mr. REYNOLDS. Yes, sir; I think I can give you some broad generalizations on it, at least.

New Mexico's average annual surface-water supply and usage can be summarized about this way.

The inflow to the State averages 2,560,000 acre-feet per year.

The yield from New Mexico's watersheds is about 3,040,000 acre-feet.

Incidentally, this arises from an average annual percipitation of about 90 million acre-feet.

Our average annual depletions of surface water amounts to about 2,110,000 acre-feet, and those are broken down about this way: 922,000 acre-feet for the irrigation of approximately 508,000 acres of land; 20,000 acre-feet for municipal and industrial use; 332,000 acre-feet of evaporation from reservoirs; 834,000 acre-feet of nonbeneficial use including channel losses and transpiration by uneconomic vegetation.

The surface-water outflow from the State, which balances this equation, amounts to about 3,490,000 acre-feet per year on the average.

Ground-water diversions in New Mexico average about 1,380,000 acre-feet per year. Of this amount about 1,260,000 acre-feet are used in the irrigation of 588,000 acres of land. On 145,000 acres of this land the ground water is used to supplement surface-water supplies. About 105,000 acre-feet of ground water is withdrawn each year for municipal and industrial purposes.

Stated simply, New Mexico's water resources problem is to achieve the fullest possible development, conservation, and control of the resources, within the limits of the interstate agreements and within the limits of economic feasibility, at any moment, in order to meet the needs of our expanding economy and population.

To illustrate this, in 1950 the State's population was 681,000 persons; at present, the population is estimated at 964,000; and it is estimated that by 1980 the State will have a population of about 2,257,000. The population of the Albuquerque metropolitan area alone will amount to 672,000 persons in 1980. According to the Bureau of Business Research at the University of New Mexico, the total number of

workers in the State increased from 202,500 in 1947 to 326,500 in 1958, or an increase of about 61 percent in the period.

This rate of increase is more than twice the Nation's 24 percent of gain in the number of workers.

The key factor in New Mexico's water-resources problem is that agricultural pursuits will provide relatively little opportunity for increased employment, and progressively larger amounts of the State's water supply must be put to municipal and industrial uses to meet the needs of the expanding population.

The CHAIRMAN. How much did you say was the annual rainfall for the State in acre-feet?

Mr. REYNOLDS. About 90 million acre-feet.

The CHAIRMAN. Is it your thought that increased storage facilities would add materially to the amount of water that would be captured and kept available for use?

Mr. REYNOLDS. Yes, sir.

I think that New Mexico does require increased storage facilities. Some of them at present are being built.

The CHAIRMAN. And you think that would increase the yield of 3,040,000 acre-feet which I believe you said was the present figure of the total yield from this 90 million acre-feet?

Mr. REYNOLDS. Yes, sir. That is the yield in terms of surface water. There is some additional yield to our ground-water reservoirs, of course, from that precipitation. The total amount made available for manageable diversions from the 90 million acre-feet is probably of the order of 4 or 5 percent of that amount or somewhere in the neighborhood of 45 million acre-feet a year that we are able to realize for diversions from our precipitation.

The CHAIRMAN. So that actually you have sources available to you for increased usable water in the reduction, transpiration, and evaporation?

Mr. REYNOLDS. Yes, sir.

The CHAIRMAN. And, of course, in developing the reuse of the water through better pollution control, you could actually get an increase of just 5 percent, or if you could get an increase in the water that you capture from the rainfall, that you have of 5 percent of the total, you more than double your available water?

Mr. REYNOLDS. Yes, sir.

I think that the watershed management practices that we were just discussing before the committee might be very helpful in that respect.

The CHAIRMAN. Go right ahead.

Mr. REYNOLDS. New Mexico is a semiarid State with a relative scarcity of water; nevertheless, substantial quantities of the resource are not as yet developed for beneficial use. Plans for further development have been formulated and must be carried out expeditiously if the expanding population and economy of the State are to be met.

The average annual recorded outflow from the State in the San Juan River is about 2,200,000 acre-feet. Under the Colorado River compacts the State of New Mexico may deplete the flow of the Upper Colorado River system by about 840,000 acre-feet per year. Present depletions of the San Juan in New Mexico amount to only about 92,000 acre-feet per annum, or less than an eighth of our share. Additional uses now authorized will cause a further depletion amounting to about 183,000 acre-feet per year.

Plans for the development of New Mexico's share of the waters of the San Juan River under the Colorado River Storage Project Act are well advanced. The first unit of construction, Navajo Dam and Reservoir, with a capacity of 1,700,000 acre-feet, is now about 45 percent complete. This regulatory unit of the Colorado River storage project will store water for the proposed 110,000-acre Navajo Indian irrigation project and the 3,900-acre Hammond project as well as water for future municipal and industrial needs in the San Juan Basin in New Mexico. The unit will also provide, of course, excellent opportunity for recreation and fish and wildlife propagation and also provide flood and sediment control.

The initial stage of the San Juan-Chama project, a proposed participating project under the act, will be limited to average diversion of 110,000 acre-feet per year, and will provide water for these depletions of the San Juan water: 29,900 acre-feet in exchange for Rio Grande system water to be used on rehabilitated irrigation units on tributaries of the Rio Grande in northern New Mexico; 22,600 acre-feet for supplemental irrigation supplies for the Middle Rio Grande Conservancy District; and 57,500 acre-feet for the city of Albuquerque.

The plans contemplate that the San Juan-Chama project would be constructed so that the works could be extended by subsequent stages of construction to provide for total diversions from the San Juan Basin to the Rio Grande Basin averaging up to 235,000 acre-feet per year.

The San Juan-Chama project plan contemplates that the city of Albuquerque will pump ground water for its increased needs, using the imported water to offset the effects of the increased pumping on the flows of the Rio Grande.

It is estimated that the allocation to the city from the initial stage of the project will very likely meet the needs of the Albuquerque metropolitan area well beyond 1980.

Other municipal and industrial requirements in the Rio Grande Basin, which may arise before or after 1980, can be met with extensions of the diversion project. Whether these future needs will be met by such extensions will depend upon the time at which future needs arise in the San Juan and Rio Grande Basins, and the State's judgment as to what distribution of the water resources of the San Juan Basin will best serve the public interest.

I think it is worth pointing out that while initial stages of the plan for the development of the waters of the San Juan River provide large amounts of new water for agricultural purposes, including the 110,000-acre Navajo Indian irrigation project, large amounts are also allocated for future municipal and industrial uses. New depletions of San Juan River water by such uses in the San Juan and Rio Grande Basins can amount to as much as 204,000 acre-feet per year on the average.

The early development of the water resources of the San Juan River is essential if the growing water needs of the State are to be met. The Secretary of the Interior's coordinated report on the San Juan-Chama and Navajo projects was transmitted to the Bureau of the Budget in September 1957, but that Bureau has not yet transmitted its recommendations on these reports to the Congress.

Senator ANDERSON. Mr. Reynolds, could you do a little bookkeeping there? You said that the total allotment from the San Juan River is 840,000 acre-feet under the compact?

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. You had about 92,000 diversion now leaving 748,000 acre-feet; 110,000 is going to be the initial stage of the San Juan-Chama project. That would leave 638,000. But you did not mention how much the Navajo project and Hammond project would take in water.

Mr. REYNOLDS. The depletion for the Navajo project, Senator, is estimated at 252,000 acre-feet.

Senator ANDERSON. 252,000 acre-feet?

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. So that would leave 386,000 unallocated thus far.

Mr. REYNOLDS. The Hammond is about 6,800.

Senator ANDERSON. 6,000; it is smaller. That leaves 380,000 roughly. So that even with the greater industrial use, New Mexico's projects would not begin to use up all the water in the San Juan.

Mr. REYNOLDS. That is right, sir.

Senator ANDERSON. So if there were a shortage to be allocated across the entire system there would still remain water in the stream.

Mr. REYNOLDS. That is right, sir.

Senator ANDERSON. I note that your statement says that this was submitted to the Secretary in September 1957 and he has not reported yet to the Congress.

Mr. REYNOLDS. No, sir.

Senator ANDERSON. Have you urged him to report?

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. Would you nudge him again?

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. Thank you.

Mr. REYNOLDS. As you know, in the last session of the Congress, legislation introduced by yourself and Senator Chavez to authorize the Navajo project in the initial stage of the San Juan-Chama was approved but House hearings on this legislation have not yet been set.

The major problems in the Rio Grande Basin of New Mexico have been the need for flood and sediment control, drainage, and the salvage of water lost to nonbeneficial plants. These problems were brought on by aggregation of the channel in the Middle Valley of the Rio Grande in New Mexico.

The waters of the Rio Grande in New Mexico are fully appropriated and the problems affect not only the water supply of users in the Middle Valley but also the State's ability to meet the water delivery requirements of the Rio Grande compact.

An attack on these problems was launched with the authorization of the Middle Rio Grande project in the Flood Control Act of 1948. Under this authorization 27 miles of levees have been completed in the Albuquerque reach of the river; Jemez Dam and Reservoir near the mouth of Jemez River are completed; Abiquiu Dam is under construction on the Chama River, a tributary to the Rio Grande; 87 miles of river channelization and rectification have been completed; rehabilitation of the drainage works of the Middle Rio Grande Conservancy District is almost complete, and about 53,200 acres of nonbeneficial water-consuming vegetation have been sprayed or cleared.

The Albuquerque district of the Corps of Engineers has recently completed a report on the proposed Cochiti and Galisteo Dams and

Reservoirs. Cochiti Dam would be built on the main stem above Albuquerque, and Galisteo Dam would be built on Galisteo Creek, a major tributary. The States of New Mexico, Texas, and Colorado have reached agreement on operating procedures for these reservoirs. The reservoirs are immediately required for flood protection and sediment control in the Middle Valley and should be authorized and constructed at the earliest possible date.

The State has cooperated with the Bureau of Reclamation and the Middle Rio Grande Conservancy District in drainage and water-salvage works to supplement the work authorized under the Middle Rio Grande project. State expenditures from Ferguson Act funds from 1952 through June 30, 1960, will total $660,000. An additional $115,000 of these funds will have been spent for water-salvage work in the Caballo Reservoir area below Elephant Butte Dam.

It is estimated that work under the Middle Rio Grande project and the supplemental cooperative work will salvage from 150,000 to 200,000 acre-feet of the average annual nonbeneficial use of 570,000 acre-feet which was occurring when the work was started. However, large amounts of water will still be lost to the evaporation and transpiration from the Rio Grande in New Mexico and further studies of potential water-salvage measures should be made. The Bureau of Reclamation is planning such studies, and it is contemplated that the State will be able to cooperate in the studies using Ferguson Act funds.

The surface waters of the Pecos River drainage——

Senator ANDERSON. Mr. Reynolds, I want to stop you there.

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. Emphasize that again, because Senator Kerr was very active in the bill that started this off with some of these projects because a great deal of this came from public works.

Mr. REYNOLDS. I understand he was, sir.

Senator ANDERSON. I did not want him to miss the fact that we are saving from 150,000 to 200,000 acre-feet of water.

I want to compliment him on his good work and also call attention to the fact that there are several thousand more acre-feet to be considered.

Mr. REYNOLDS. That is right, sir.

The surface waters of the Pecos River drainage basin in New Mexico are also fully appropriated. These waters are apportioned between the States of Texas and New Mexico by the Pecos River compact which was approved by the Congress of the United States in 1949.

The principal problems of the Pecos River are siltation of the river channel and existing reservoir capacity, salinity, flood control, and nonbeneficial consumptive use of water by evaporation and transpiration.

These problems are presently acute and conditions will worsen unless corrective action is taken.

The Federal agencies, the Pecos River Compact Commission, the States of New Mexico and Texas, and local interests are cooperating to develop solutions to the problems of the Pecos River. Los Esteros Dam is proposed by the Corps of Engineers for construction on the river at a point about 7 miles above the town of Santa Rosa. These

works would provide flood protection and conservation storage to replace conservation capacity in Alamogordo Reservoir. It is estimated that, under present conditions, siltation will make this latter reservoir ineffective as upstream storage for the Carlsbad Irrigation District within about 40 years.

The 85th Congress authorized the McMillan Delta water salvage project. The water-salvage project contemplates the construction of a low-flow conveyance channel and cleared floodway through the delta of McMillan Reservoir, the terminal storage of the Carlsbad Irrigation District. It is estimated that these works would salvage approximately 24,000 acre-feet of water per year that is presently nonbeneficially used. The legislation provides that the floodway shall not be cleared until provision is made to replace McMillan Reservoir storage capacity that would be lost by accelerated siltation resulting from the floodway clearance. The Carlsbad Irrigation District has accomplished some channel improvement and drainage work in the delta. The Bureau of Reclamation is currently studying the feasibility of constructing a low-flow conveyance channel without a cleared floodway and the practicability of utilizing the work already constructed by the district as a part of the low-flow channel.

A recent report of the Bureau of Reclamation, which is currently under informal review by affected interests, describes a plan of development for water salvage, flood control, and replacement of conservation storage on the Pecos River.

This plan includes construction of the authorized Los Esteros Dam and Reservoir and the construction of Brantley Dam and Reservoir to a capacity of 297,000 acre-feet at a site about 4 miles downstream from the existing McMillan Dam. Brantley Dam and Reservoir would provide sediment control, flood protection, and conservation storage for the Carlsbad Irrigation District, to replace that function of McMillan Reservoir, as well as a permanent pool for recreation and fish and wildlife propagation. Some storage capacity in McMillan Reservoir would be retained for fish and wildlife propagation.

The Bureau report describes a comprehensive plan for water salvage in the reach of the river from Alamogordo Reservoir to Carlsbad. The data in the report suggest that the amount salvagable under present conditions is approximately 75,000 acre-feet per annum. The report emphasizes that unless corrective action is taken nonbeneficial consumptive use may be expected to increase markedly in the next 50 years, ultimately depleting the water supply by almost 340,000 acre-feet annually.

The Bureau report also discusses the power potentialities in the Pecos gorge near the mouth of the river, concluding that the power project is not presently economically justified. Continuing attention should be given this potential power project and it should be developed at the earliest possible time in order that a basin account can be established to provide financial assistance in meeting the problems of the Pecos River. The basin power account could be used to repay to the Federal Government construction and rehabilitation costs beyond the ability of the water users to pay.

New Mexico, in her role as an upper basin State under the Colorado River compact, is a party in Supreme Court litigation over the waters of the Lower Colorado River system. In this litigation New Mexico

has asked for an equitable apportionment which would permit substantial new uses from Lower Colorado River tributaries in New Mexico. The contempleted ultimate total depletion at sites of use amounts to 111,700 acre-feet, or approximately 56,700 acre-feet more than present depletions.

Planning for further development of the Gila River and its tributaries in New Mexico has been conducted by the State, the Bureau of Reclamation, and the Corps of Engineers. Further consideration of these plans awaits a decree in the current litigation. It is contemplated that the State will require the assistance of the Bureau, the corps, and other Federal agencies in developing and carrying out these plans.

The Canadian River compact provides that New Mexico shall have free and unrestricted use of all waters originating in the drainage basin of the Canadian River in New Mexico below Conchas Dam, provided that the amount of conservation storage in New Mexico available for impounding these waters shall be limited to an aggregate of 200,000 acre-feet.

An act of the 1959 State legislature authorized the New Mexico Interstate Stream Commission to issue bonds guaranteed by $5 million of severance tax revenues to finance the construction of dams on the Canadian River or its tributaries between Conchas Dam and the Texas border. The act also provides that the severance tax funds used to pay the interest and principal of the bonds shall be repaid from water revenues as they become available.

Preliminary studies indicate that the initial stage of a dam and reservoir having an ultimate capacity of about 365,000 acre-feet can be constructed for about $5 million. The dam would be constructed on Canadian River just below the confluence with Ute Creek. The initial stage, having a total capacity of about 170,000 acre-feet would yield about 40,000 acre-feet of water per year. This water would be used for agricultural and municipal and industrial purposes. Flood and sediment control, recreation, and fish and wildlife propagation would also be purposes of the project.

Preliminary estimates suggest that water in the reservoir can be made available to industry at a cost of around 1.4 cents per 1,000 gallons. This price should be attractive to industry and there is good reason to believe that the second stage of construction which would make available an additional amount of approximately 25,000 acre-feet of water per year can be financed with water revenues before 1980.

The use of ground water for irrigation in the State of New Mexico has developed rapidly in the past 20 years. In 1940 an estimated 140,000 acres were irrigated with ground water; in 1950 an estimated 320,000 acres; and in 1955 an estimated 588,000 acres.

The locations of all large supplies of ground water in New Mexico are generally believed to be known and an increase in ground-water usage in the next 20 years comparable with that of the last 20 years cannot be predicted.

In the declared Animas, Mimbres, Playas, Portales, Lea County, and Estancia Basins, as well as in some other areas of intensive ground-water irrigation, water is being withdrawn primarily from storage, and water levels will continue to decline. The time limit for irriga-

tion in the House, Clovis, Portales, northern Lea County, and Causey-Lingo areas on the Southern High Plains and in the Estancia Valley in central New Mexico is set by the thickness of the saturated aquifer, whereas the thickness of the aquifer in most of the Animas, Mimbres, and Playas Basins is so great that pumping costs will probably limit withdrawals of water for agriculture long before the water supply is actually exhausted.

It is desirable, of course, that the ground-water resources be available to future generations in perpetuity; however, the mining of water can be justified as readily as the mining of any of our other mineral resources, such as uranium, oil, or coal. It is not practical to operate a ground-water basin on a continuous-yield basis when the amount of water in storage is very large compared with the average annual recharge. An example is the Lea County Basin in southeastern New Mexico, where the average annual recharge is 29,000 acre-feet per year and the permitted withdrawals will average about 440,000 acre-feet per year. The great value of the approximately 27 million acre-feet in storage in the basin when pumping began can be realized only by ground-water mining.

While it is possible to justify the mining of ground-water resources, the practice will make it necessary to face serious water-supply problems in the future. In some instances it will be possible to meet these problems only by complete readjustment of the economy of the area. While long-range predictions of the value of water in various uses are dangerous, it appears likely that, in general, it will not be economically feasible to import water over appreciable distances for agricultural purposes when the local ground-water resources have been mined out. However, when reduced well yields or excessive lifts make pumping for agricultural purposes uneconomical, the residual water may well supply the needs of a vigorous nonagricultural economy for many years.

The Roswell artesian basin is susceptible to operation on a continuous yield basis but the present withdrawal of about 440,000 acre-feet per year amounts to about 190 percent of the currently estimated safe yield. This amount of water is the total withdrawal from the artesian and shallow aquifers for the irrigation of about 132,000 acres of land and for municipal and industrial use in the area. This apparent overdraft coupled with protracted drought has resulted in serious conditions in terms of artesian head lowering, salt-water encroachment in the artesian aquifer, and depletion of water in storage in the shallow-water aquifer.

A water rights adjudication suit now before the court may reduce the total irrigated acreage by 10,000 to 15,000 acres. The Pecos Valley Artesian Conservancy District is giving consideration to the purchase and drying up of valid ground-water rights to reduce the annual withdrawals. Also, Federal, State, and local interests are cooperatively studying possibilities for artificial recharge or water-salvage measures that might be employed without impairing existing surface-water rights.

Senator ANDERSON. I do not know of too much new land in the Carlsbad project where you mention the fact that the intake is about 29,000 feet and outflow is about 445,000 feet.

Mr. REYNOLDS. This is in Lea County, Senator.

Senator ANDERSON. That is a ground-water area?

Mr. REYNOLDS. Ground water entirely.

Senator ANDERSON. How much is the ground-water level dropping over there?

Mr. REYNOLDS. I cannot give you a precise figure at the moment. Actually the withdrawals at the time are only about 190,000 acre-feet per year. Permits are somewhat in excess of that. But the ground water in the Lea County declared basin is not yet fully appropriated in all areas. There will be some increase there.

Senator ANDERSON. In the Roswell area there is quite a bit of new lands coming in. I drove down a short time ago. I guess it is about 19 or 20 miles out where there is quite a little new development.

Mr. REYNOLDS. In the Roswell area?

Senator ANDERSON. Yes.

How much increase in acreage has there been in and around Roswell in pumping?

Mr. REYNOLDS. I would say none recently, Senator. There may have been some changes.

Senator ANDERSON. What do you mean recently?

We went back to Coronado days a while ago. We do not mean that far back?

Mr. REYNOLDS. That basin was closed to new appropriations in 1947, the last extension.

Senator ANDERSON. You say no new pumps since 1948?

Mr. REYNOLDS. Of course, a large number of new wells were drilled down there, replacement wells and moving of water rights. That may account for some of the new development that you might have seen. Somebody may have moved his land.

The CHAIRMAN. If there are new wells then there must be new means to secure water already appropriated and signed.

Mr. REYNOLDS. That is right, sir. All the waters of the Roswell Basin are fully appropriated. There have been no new appropriations permitted down there for many years.

The CHAIRMAN. Just a replacement.

Mr. REYNOLDS. That is right. That goes on continually—where a fellow's well has deteriorated to such an extent that he has to drill a new one, because of a corroded casing and things of that sort.

Senator ANDERSON. Do you know anything about dropping of the water level in the Roswell area?

Mr. REYNOLDS. There of course have been continuing declines there.

Senator ANDERSON. About how much?

Mr. REYNOLDS. Senator, I would be hesitant to give you rates of decline. I can furnish that information. I am not prepared to do it here this morning.

Senator ANDERSON. Would you supply it for the record about the amount of the drop of water.

(Charts furnished for the committee files by Mr. Reynolds show drops in the water level ranging from about 25 feet at Berrendo to 100 feet at Artesia during the period 1932–57.)

The CHAIRMAN. He says, as I understand his statement, that the present withdrawal is 440,000 acre-feet per year and that is 190 percent of an amount that could be withdrawn without the continued reduction or lowering of the table.

Mr. REYNOLDS. That is right, sir.

Senator ANDERSON. The safe yield.

Mr. REYNOLDS. There are a number of observation wells, in the Roswell area of course. When you start talking water level declines you need to know which well you are talking about and which period.

Of course these water level declines have been accentuated and aggravated by continuing drought down there.

Senator ANDERSON. Of course, continuing drought has been going on all over the United States for the past 25 years. If the predictions of experts are at all true, the temperate zones are not changing and continuing droughts will be the pattern for the next 150 years.

Mr. REYNOLDS. This is a relative thing. When I speak of drought I mean relative to what we enjoyed until, let us say, to 1948.

Senator ANDERSON. Yes. But also remember when the Colorado River Commission was sitting in Santa Fe in 1921 and 1922 they were measuring a river that had 30 million acre-feet of water in it. Now, if you have 15 million acre-feet of water we consider ourselves lucky. That is 35 years and continuing drought——

Mr. REYNOLDS. That is right.

Senator ANDERSON. Steadily progressing droughts, which you have to face that in these areas.

Mr. REYNOLDS. That is right.

They were considering a rather brief record there at Santa Fe unfortunately, not long enough to truly represent the hydrology of the river, I believe.

Senator ANDERSON. But it was all the known record there was.

Mr. REYNOLDS. That is right, sir. I say unfortunately it was too brief, although it was all that was available to them.

Our present knowledge indicates that, in most areas of intensive ground water usage in the State, pumpage can be continued at present rates well beyond 1980. Exceptions are the Portales Valley and localized marginal areas.

The data that I have cited reveal the State's adjustment from an agricultural to an urban economy and show that it will be necessary to put increasing amounts of water to municipal and industrial use to meet the needs of this changing economy. Expeditious development of the water-resource plan that I have described, can meet those needs to 1980 in the San Juan, Rio Grande, and lower Canadian River Basins in New Mexico. Also, with an equitable apportionment of the waters of the lower Colorado River system in the decree in *Arizona* v. *California*, the municipal and industrial needs in the area drained by the lower Colorado River tributaries in New Mexico can probably be met.

In other areas of the State growing municipal and industrial needs can be met by purchasing water rights presently being exercised for irrigation. New Mexico statutes permit the change of point of diversion and change of place and method of use of water rights if such changes will not impair other existing rights to the use of water. Both municipalities and counties have the power under New Mexico law to condemn water rights for public purposes.

At the present time about 93 percent of all water diverted in New Mexico is used for irrigation. Most of the balance of 7 percent is used for municipal and industrial purposes. Only minor amounts are di-

rectly chargeable to recreation, fish and wildlife propagation or to stock, and nonagricultural rural use. Thus it can be seen that municipal and industrial usage could be doubled by a reduction of only about 7.5 percent in the amount of water used in the agricultural economy of the State.

In conclusion, I wish to express the appreciation of the State of New Mexico for this opportunity to present its water resources needs and problems for the consideration of this committee.

The CHAIRMAN. I want to thank you for that very enlightening presentation. It was very interesting.

Mr. REYNOLDS. Thank you, Senator.

Senator ANDERSON. One moment, Mr. Reynolds.

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. On this Canadian River project which you say is going to run $5 million. Did you get that figure correctly?

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. Do you need any help from the Federal Government on that? Do you have all the money you need in the State to do all the work you need to do on the design of that dam and so forth?

Mr. REYNOLDS. We cannot be sure of that, Senator. As you know, Senator Chavez has introduced legislation which will provide a Federal contribution to the project in recognition of the sediment, flood control benefits and fish and wildlife propagation and recreation benefits.

Senator ANDERSON. I do know—and I sponsored the bill. I want to get something in the record to find out the State of New Mexico's attitude toward the bill.

Mr. REYNOLDS. We think those benefits are going to be very appreciable and that there will be opportunities for the Federal Government to help us materially in the construction. Our final cost estimates are not yet available.

Senator ANDERSON. You do recognize that the Federal Government will make some contribution.

Mr. REYNOLDS. Yes, sir.

Senator ANDERSON. And proceed more rapidly to this Canadian River work?

Mr. REYNOLDS. Yes, sir.

We plan, of course, to coordinate our plan of development with the Federal agencies very closely, when the plans have been burned up, and we are using the services of the Federal agencies in the planning stages.

Senator ANDERSON. Thank you.

Is I. J. Cory here? He was invited to come if he desired to come. Tom Popejoy, the president of the University of New Mexico. Is he here? Dr. Corbett, president of New Mexico State University, or Dr. E. J. Workman, president of the New Mexico Institute of Mining and Technology. Are they here?

STATEMENT OF E. J. WORKMAN, PRESIDENT, NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

Dr. WORKMAN. Senator Kerr and Senator Anderson.

My name is E. J. Workman. I am from Socorro, N. Mex., where I am president of the New Mexico Institute of Mining and Technology.

I have prepared some qualitative statements which I should like to leave for the record and yield my time to people who wish to speak more quantitatively about this subject, if that is all right.

(The information referred to follows:)

STATEMENT OF E. J. WORKMAN, SOCORRO, N. MEX.

In accepting the invitation to give information before the Select Committee on National Water Resources, I indicated that I should perhaps limit my discussion to education in ground-water resources, and to weather-modification problems.

I have studied the ground-water problem with respect to its related educational facilities in the United States, and I have had some experience in the development of a program of postbaccalaureate education in this field; also, I have participated actively in research programs involving the technology of ground water. I assure you that a need for a tremendous expansion of our program of education and research has been apparent for a decade or more. Actually, very little is being done in the United States in the way of academic research and education on this subject. As a result, we find ourselves lacking basic information in all aspects of water-resources problems, from legal philosophy to water-well development. What is worse, perhaps, is the fact that before developing the fund of basic information which is sorely needed we shall need to develop the interest and capabilities of people who will contribute to the field and teach others. This condition of affairs can do nothing but lead to emergency management, and certainly we must admit that emergency management is poor management. Your committee communication of September 3, entitled "Information Desired by the Senate Select Committee on National Water Resources at Field Hearings" gives ample support to the need for expanding greatly our facilities for research and education. The eight questions which are stated cannot be answered satisfactorily by the deliberations of this or any other committee. These questions develop from a lack of background information of the kind expected to be on library shelves. Such information normally is found in doctors' dissertations and in the reports and publications of research fellows in the related fields.

In order to have an educational program, one needs students and scholars to teach them. Whether we like it or not the job outlook appears to be becoming more and more a determining factor in the students selection of professional training. The outlook for professional employment in the water resources fields is not alluring to the young men and women today. Nearly all of the positions available are with the Government of the Nation and its subdivisions. In nearly all cases the salaries are not competitive with those of other professions—notably physics, chemistry, geophysics, and mathematics. It would seem, therefore, that the most urgent need is to provide some artifical stimulus to the educational processes in this field. I am confident that once people are trained they will find something to do. Training of the qualified investigators must come first. Up until recently physicists, chemists, geophysicists, and mathematicians appeared to be in surplus in our social and economic scheme of things.

I should like to recommend that the Federal Government make available from 100 to 1,000 fellowships, each adequate to support a qualified student in full-time graduate-study programs bearing on water resources. Perhaps no more than 100 of such fellowships could be used initially in the rigorous field of ground-water hydrology because here we do not have the capacity in scholarship that would be required for effective training of advanced students. It would appear, however, that at least 900 of such students could devote themselves to the subject matter of questions 1 through 8 of the reference-information bulletin. Such a program would cost at the most about $4 million or $5 million a year. It would provide for a sound and certain development of this important requirement for our national health and welfare.

The subject of our national needs with respect to weather modification are, I believe, relatively simple to state. Certainly there are innumerable things that we should like to do about modifying the weather. I have had a great deal of experience with the subject of weather modification, particularly as applied in efforts to increase precipitation, and I regret to say that the current outlook of this technology is gloomy. The reason is very simple to state. The engineering practices currently used are, for the most part, founded upon a mistaken

notion concerning the nature of natural precipitation processes. At the time that the late Dr. Langmuir and associates made their remarkable contribution to science on the behavior of ice crystals and ice crystal seeds in supercooled clouds, meteorologists held that ice crystals grown by sublimation were an essential ingredient of clouds if precipitation processes were to be initiated. Now there are a lot of things that we do not know about precipitation processes, but we do know that the major premise just stated is no longer tenable. I should like to have it clearly understood that I am not here declaring that weather-modification techniques might not be developed at some future time, but rather I submit that little or no good—and possibly great harm—will result from the techniques currently used. In a sense we are treating the atmosphere for an ailment which it does not have. We may need to work on the subject of weather modification at some future time, but first of all it is both necessary and expedient for us to learn the basic factors and here our problem is much like that which exists for water resources in general. We need well-qualified students and fellows to work in the laboratory and in the field toward developing a background of information in order to understand better the physics and chemistry of the atmosphere. Unfortunately, meteorology, like many of our professional subjects, has been taught by practitioners according to a design by practitioners and such an educational system is no longer tolerable. Meteorology, unlike some of the other fields, is changing because a large number of scientists in the basic fields related are conducting research and teaching research findings to their students. In all fairness, I should say that many more-or-less classical meteorologists have been lured into basic research activity and future developments, I believe, are assured.

It is desirable and necessary that we continue in the somewhat explosive expansion of research in atmospheric physics, but there is serious doubt as to whether a large-scale engineering effort in weather modification should be sponsored, or even tolerated, until a proper basis in physical understanding is available.

Senator ANDERSON. For your benefit, Senator Kerr, Dr. Workman is one of our distinguished scientists and not only heads our school at Socorro, but during the last war was extremely active in projects that turned out to be extremely beneficial to the Federal Government, including such things as proximity fuses.

Dr. WORKMAN. Thank you, sir.

Senator ANDERSON. Thank you, Dr. Workman, for coming.

Is Paul Jones here? I think he is coming. I invited Mr. Jones in behalf of the committee. He is the chairman of the Navajo Tribal Council.

Mr. Alvin Thompson, State director of the bureau of mines.

STATEMENT OF ALVIN J. THOMPSON, DIRECTOR, NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES, DIVISION OF NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

Mr. THOMPSON. Senator Kerr and Senator Anderson, my name is Alvin J. Thompson. I am director of the New Mexico Bureau of Mines and Mineral Resources Division of the New Mexico Institute of Mining and Technology.

I have a few statements on the use and utility of water in the mining industry.

The New Mexico Bureau of Mines is a State-supported agency which serves the State through service to the mineral industry and I am appearing before this committee to make a few statements concerning the utilization and need of water in the mineral industry of New Mexico.

In a large measure New Mexico owes its rapid development and expansion to the activities of the companies in the mineral industry. The

mineral production in New Mexico now has a value approaching $600 million annually. The assessed valuation of mineral industry property is around $340 million, about one-third of the total assessed valuation in the State.

Although not an excessive consumer of water, the mineral industry needs substantial amounts of water for carrying on its activities. A rough estimate of the total amount of water used directly in mining and milling activities in the State is 60,000 acre-feet per year. This is out of a total estimated use of water in the State of 3 million acre-feet. The indicated value added by mineral production per acre-foot of water used is $10,000, a very high figure compared to the average value added for all products produced in the State as a whole.

Because of the high economic yields that are possible when water is used for mining purposes it would appear that new mining developments in the State should receive a high priority as new needs in mining arise. New Mexico mining industry is growing. Its growth has been something near phenomenal in recent years. There has been a tenfold increase in the value of New Mexico's mineral production during the last 20 years. I have calculated that the mineral production since 1950 is in excess of that of all the years prior to that time. On a per capita basis, the value of production is now exceeded only by Wyoming of all the 50 States.

There is reason to believe that New Mexico's mineral production will continue to grow markedly. The total value of this production could easily reach and exceed a billion dollars in the course of not so many years. Although it is not always easy to anticipate the exact areas of growth, one particular potential appears especially promising.

New Mexico stands well to become a leading energy-resource State. It now ranks seventh in the production of petroleum, third in the production of natural gas, and first in the production of uranium. Its reserves of uranium are in excess of the total of all other States combined. New Mexico's coal reserves are estimated at 60 billion tons, or enough to last the whole Nation for 70 or more years. The fuels of which this State has unusually large reserves—that is, coal, petroleum, natural gas, and uranium—completely overshadow the other energy sources, such as wood and falling water.

The development of New Mexico fuel resources will depend in part on the availability of water for powerplants to utilize these fuels. It requires approximately 1 gallon of water to develop 1 kilowatt-hour of electrical energy. Large power projects in the San Juan Basin which would require a diversion of from 50,000 to 60,000 feet of water per year are already in the planning state. Chemical and industrial projects that have been proposed for use in the area in conjunction with the power projects would perhaps double or triple the water requirements.

There are other potential developments which may call for substantial quantities of water in both the metal and nonmetal fields. In this regard I would only want to point out that there is an increasing interest being shown by large and established mining companies in the mineral deposits and prospects within this State. I believe that the exploration programs planned and in progress could very well result in doubling or tripling before very long the current water

requirement needed by the mineral industries of New Mexico in their mining, processing, and perhaps fabricating industries.

An overall estimate of the water requirement of the New Mexico mineral industry in the next decade or so can be expected to reach and perhaps greatly exceed 100,000 acre-feet annually.

Thank you.

Senator ANDERSON. Thank you.

Dr. Workman, do you have an extra copy of your paper?

Dr. WORKMAN. Yes, sir; I have.

Senator ANDERSON. Would you give it to Senator Kerr so he will have a chance to glance over it?

He may have a question to direct to you at a later time.

Senator ANDERSON. Charles Caldwell, Department of Public Health at Santa Fe. Will you state your name for the record and the position you occupy here today, Mr. Caldwell?

STATEMENT OF CHARLES G. CALDWELL, STATE SANITARY ENGINEER, DEPARTMENT OF HEALTH, SANTA FE, N. MEX.

Mr. CALDWELL. My name is Charles G. Caldwell. I am State sanitary engineer.

The statement of the existing situation and present trends by the New Mexico Department of Health follows:

The New Mexico Department of Public Health is primarily interested in water resources involving water supplies for domestic, commercial, and industrial purposes. As other State agencies have provided the committee with general water requirements for New Mexico until 1980, it is felt that conditions of special significance to the Southwest will be of most value at this hearing. These items are:

1. The high per capita demand for water. This may be as high as 200 to over 500 gallons per person per day during the hot, dry summer months.
2. The shortage of water for all purposes. This is particularly true for agricultural, industrial, and recreational uses.
3. The existence of waters of marginal or unsatisfactory quality, that cannot now be used.
4. The extreme variations in available water due to the extended drought cycles.
5. The high evaporation losses from impounded waters.
6. The need for multiple use of available water for domestic, industrial, agricultural, and recreational purposes.
7. The lack of any water for dilution of wastes, in most instances.
8. The exceptional demands for the use of all impounded waters for recreational purposes and the resulting problems in the control of municipal water supplies.

SUMMARY OF WATER RESOURCES AVAILABLE

The availability of adequate quantity or quality of water is a limiting factor in the development of the arid Southwest.

In New Mexico the almost full appropriation, and some overappropriation, of surface water rights together with the presence of closed underground water basins have resulted in water shortages. Extended drought periods have accentuated this problem. Under these

conditions the conservation of all water resources is vitally important so that maximum water usage is possible. The supplementation of community water supplies is becoming an increasingly difficult problem. Use of waters of undesirable chemical quality for domestic purposes is common in New Mexico, as no other economical source is usually available.

GROUND WATER PROBLEMS

Municipal and industrial water supplies in New Mexico are derived mainly from ground water sources. In most instances, these sources are of limited capacity, and protection against pollution or contamination is very important. Drops in the ground water table and encroachments by adverse quality water have become serious problems. Control through declaration of additional closed or limited basins is a growing policy.

WATER USE FOR POLLUTION ABATEMENT

The unreliability of continuous flow in practically all streams in the State drastically limits the use of dilution water for pollution abatement purposes. However, the almost-complete reliance on surface waters in the San Juan Basin in northwestern New Mexico has created the need for definite pollution control measures that include stream dilution waters. The full use developments of the San Juan and Animas Rivers in Colorado and New Mexico will make dilution requirements critical for water pollution control.

Projections of future demands for water and water-related activities considering relationships of availability and costs.

POPULATION PROJECTIONS

The Southwest is growing quite rapidly in spite of the shortage of water resources. Hence, a 50 percent increase in population by 1980 is not unreasonable, and this figure could easily be exceeded, on the basis of the past two decades.

MUNICIPAL WATER USE

Domestic water use is increasing by both population growth and the per capita demand for modern household equipment, such as washing machines, dishwashers, garbage disposals, coolers, et cetera. It is expected that this average demand per capita per day will exceed 150 gallons by 1980. High temperatures combined with low humidity can cause summer peaks of 3 to 4 times this average, for the State of New Mexico.

Senator ANDERSON. Where did you get the 150-gallon figure?

Mr. CALDWELL. We got that from our surveys of municipalities, Senator.

Senator ANDERSON. What is the national average?

Mr. CALDWELL. It runs about 150.

The CHAIRMAN. That is an average on the year-round basis?

Mr. CALDWELL. On the year-round basis, that is right.

The CHAIRMAN. An indication of your statement is that it is much less than that for 7 or 8 months of the year and much more than that for the other months.

Mr. CALDWELL. It does return a little lower but the average demand will exceed 150 for 1980.

Senator ANDERSON. Yes.

Mr. CALDWELL. That is generally an accepted figure, 150.

Senator ANDERSON. You do not want to give a wrong figure. I had a wrong figure in my mind. But go ahead.

Mr. CALDWELL. Present investment per capita based on replacement cost of all water resources developments in the United States is estimated to be about $1,026. Water and sewage utilities account for nearly one-third of this total, that is expected to increase to about $1,700 per capita by 1980, on the basis of present costs.

The CHAIRMAN. I would like to stop right there a moment and get in the record a translation of the terms of total amounts required. In other words, the present investment per capita based on replacement costs, if it is $1,000 per capita that means that the $180 billion is the present value of investments in all water resources development in the United States.

Mr. CALDWELL. That would add up.

The CHAIRMAN. And your expectation is that by 1980 the increased amount that should be expended to meet the needs that will exist in 1980 is about $700 per capita on the basis of the present value of the dollar.

Mr. CALDWELL. That is right.

The CHAIRMAN. And the 180 million people with the required expenditure of $700 per capita adds up to $125 to $130 billion that would be required to be spent if your figure is based on the present population, and I presume it is.

Mr. CALDWELL. It is, it is based on present population.

The CHAIRMAN. And I think the figures are in line. I think the estimate really is conservative. But when you reduce it to total figure and find that we are confronted with the necessity of spending $125 to $130 billion in the next 20 years of State, local, and Federal money to meet the requirements of the increased needs of the people in this country you can immediately understand the complete antiquity and futility of the proposal of no new starts in the field of water development.

Mr. CALDWELL. That is right.

The CHAIRMAN. I do not ask you to concur in that conclusion.

Mr. CALDWELL. I think you are on firm ground.

The CHAIRMAN. I just state it as my own.

Mr. CALDWELL. I think that is right.

WATER NEEDS OF INDUSTRIES (INCLUDING ATOMIC)

Industrial water demands are increasing, but the general unavailability of unappropriated water has prevented much industrial expansion in the State. This is particularly true of industries that require large quantities of water for their operations.

WATER RECREATION

The increased demand for water recreational facilities in an area of limited water resources has emphasized the need for water pollution control to provide maximum multipurpose use of most of the waters in the State.

FISH AND WILDLIFE

The same statements in regard to water recreation apply to fish and wildlife.

TRENDS IN USE OF WATER FOR WASTE DISPOSAL

The lack of dependability on minimum flows in nearly all streams in the State eliminates the use of dilution waters for waste disposal in most cases. Recreational demands on streams are requiring higher degrees of waste treatment and even elimination of discharges entirely. The initiation of plans for the complete development of water resources in the San Juan Basin of northwestern New Mexico is creating problems of chemical and bacteriological quality of this water that is used for both municipal water supplies and waste disposal.

MEANS OF MEETING FUTURE DEMAND (NEW TECHNIQUES)

Conventional methods of adding new supplies and costs thereof: New supplies are being added for municipal water supplies by going farther and farther afield from the community to convey water by pipeline. Costs are directly proportional to the lengths of pipeline involved. Examples of distances involved for the comparatively small New Mexico communities for recent developments are over 80 miles for Alamogordo and Holloman Air Development Center; 22 miles for Vaughn; 11 miles for Eunice; and 5 miles for Jal. Gallup is currently investigating a source of development that will involve 25 to 30 miles of pipeline. This procedure will be repeated more and more in the future if adequate municipal water supplies are to be maintained by New Mexico communities.

VEGETATIONAL MANAGEMENT AND EVAPORATION REDUCTION

Control of water losses can be a definite aid to municipal water supplies that involved use of surface waters.

DESALINIZATION

Rapid progress in this field of water improvement is significant as a future supplementation of municipal water supplies. Numerous New Mexico communities have extremely difficult water supply problems due to unsatisfactory quality of available waters.

Eleven New Mexico communities applied for consideration of installation of a plant by the Office of Saline Water.

The CHAIRMAN. To whom did they apply?

Mr. CALDWELL. The Office of Saline Water, sir.

The CHAIRMAN. In Washington?

Mr. CALDWELL. Yes, sir.

The CHAIRMAN. Fine.

Mr. CALDWELL. And the committee was out here about a week ago?

The CHAIRMAN. Fine.

Mr. CALDWELL. And four of them, Alamogordo, Carlsbad, Roswell, and Santa Rosa, are being given serious consideration for the plant that is to be installed in the Southwest. Present overall costs of desalinization of water are just under $1 per 1,000 gallons. If this

figure can be cut to 50 cents to 60 cents per 1,000 gallons, a competitive demand for use of this equipment will be practical in many instances.

The CHAIRMAN. What you are telling us is, if I understand it, that if desalinization of water can be achieved at a cost not to exceed 50 to 60 cents per 1,000 gallons, it will be in high demand for municipalities.

Mr. CALDWELL. Yes, sir.

The CHAIRMAN. That will require use of it and a feeling that they have moved in the direction of solving their problem by being able to acquire usable water at that figure.

Mr. CALDWELL. We have great quantities of brackish water that can be reclaimed that way, Senator.

The CHAIRMAN. Are you familiar with the average range of quantities of hardness in that water which would be subject to treatment as it now is?

Mr. CALDWELL. We have an appendix that is a part of this statement, sir, that gives the quantities of chemicals.

The CHAIRMAN. Do you have the figure in your mind?

Mr. CALDWELL. The quantities?

The CHAIRMAN. No. The degree of hardness. It is expressed in terms of so many parts per million of gallons.

Mr. CALDWELL. For instance, in the east side it runs up to 400 to 600 parts per million.

The CHAIRMAN. Now, to what extent does that need to be reduced in order to consider the operation successful?

Mr. CALDWELL. If we could reduce it to around 200 to 250 we would be happy.

The CHAIRMAN. You would?

Mr. CALDWELL. Yes, sir.

Senator ANDERSON. I am in trouble now.

The CHAIRMAN. On that statement?

Senator ANDERSON. No, but because I cannot translate it.

Water down here in the valley taken close to the surface of 85 feet will run about 20 grains of hardness. How do I get it down to parts per million?

Mr. CALDWELL. 1,700 grains per gallon equals 1 part per million.

The CHAIRMAN. It was what?

Mr. CALDWELL. One part per million.

Senator ANDERSON. So that water would be 330 parts per million?

Mr. CALDWELL. I think you are right. I think that is about right.

Senator ANDERSON. Twenty times seventeen?

Mr. CALDWELL. That is right.

Senator ANDERSON. When we get water that runs 30 grains that is about the figure you are using?

Mr. CALDWELL. That is getting up pretty high.

Senator ANDERSON. City water in Albuquerque is about 4 grains.

Mr. CALDWELL. That is right Senator.

The CHAIRMAN. That is about how many parts per million?

Senator ANDERSON. Sixty-eight.

Mr. CALDWELL. Sixty-eight, yes.

The east side is our critical area, Carlsbad, Roswell, Artesia, those towns down there, Alamogordo.

The CHAIRMAN. For the information of the witness and to get a little better perspective of the picture that Senator Anderson indicated, the committee visited a desalinization project in Redfield,

S. Dak., where they are treating water which comes out of the ground with 3,000 parts of hardness per million and they are reducing it to about 300 parts per million by the operation and regard that as being a phenomenal result.

Senator ANDERSON. Senator Kerr, this is purely a venture on my part now to find out what I spent some money for a while ago. I had about 19 grains water at my farm. I wanted to get it down to 4 or 5 grains, and I got down to 10 grains at 160 feet. The well driller advised me to stay with it because they had a great flow of water. I went down to 245 feet where I got four grains. I was trying to translate it against this other to find out what I spent my money for. It has nothing to do with the hearings this morning.

This is a financial venture of my own.

The CHAIRMAN. I want to tell you the information is very pertinent in this hearing, because when a witness of recognized standing and ability and responsibility tells this committee that when the possibility of desalinization of water gets a result of less than 300 parts of hardness per million gallons at a cost of 50 to 60 cents a 1,000 gallons has desirable economics to it, he is telling this committee things and giving it information of very significant implications and importance. I am glad to have it in the record.

Mr. CALDWELL. Thank you, Senator.

Senator ANDERSON. May I go back now and ask you again about this 150-gallon figure?

Mr. CALDWELL. Yes.

Senator ANDERSON. Dr. Ackerman agreed that the figure is correct, and I just finished making a talk to the League of Women Voters and one of us is going to have to straighten this thing out because I told the League of Women Voters that it took 470 gallons of water to make a barrel of beer and 4,700 gallons for a ton of coke and 12,000 for a ton of steel, and I said we now have figures prepared by a large industrial firm that ran 1,100 gallons per day for every man, woman, and child in the United States, 200 billion gallons a day over the Nation. Your figure would come out to about one-tenth of that.

Can you account for this discrepancy between the Institute of Pump Manufacturers and figures that you have given?

Mr. CALDWELL. Is the Institute of Pump Manufacturers, Senator—what figures do they use?

Senator ANDERSON. 1,100 gallons per day on the basis of 200 billion gallons a day over the Nation.

Mr. CALDWELL. We use design figures in New Mexico of 150 gallons per capita per day.

The CHAIRMAN. Are you talking about domestic water consumption?

Senator ANDERSON. I am talking about all consumption.

Mr. CALDWELL. You are talking about all consumption. That explains the difference, I imagine.

Senator ANDERSON. It is expected that the average demand per capita today will exceed 150 gallons by 1980. Dr. Ackerman said he felt that is an accurate figure.

The CHAIRMAN. He starts his paragraph talking about domestic water.

Mr. CALDWELL. Domestic water.

Senator ANDERSON. I know. All right. You are just keeping it to domestic water?

Mr. CALDWELL. That is right. That is what we are talking about.

Senator ANDERSON. I feel better.

The CHAIRMAN. I think the interjection into the record at this point of the figure you are using is quite important, and I would like for the record to show what the overall requirements per capita of water in the Nation are at this time and what reliable information indicates that the overall requirements will be in 1980. I think it is very important that that be in the record.

Senator ANDERSON. One of the reasons, Senator Kerr, that I brought it up was that it takes 65,000 gallons of water to convert iron into 1 ton of steel. We turn out an awful lot of steel in this country. You just multiply the tonnage of steel by 65,000 gallons and you realize that this whole picture ties together into a tremendous demand.

While it may be true that domestic water supply is only 150 gallons per day per person, sometimes that does not count swimming pools. I saw a plat of an area in Phoenix that was being developed and they had six houses on each side of the street on this particular block and back of each one was a swimming pool put in diagonally so it could be long enough to take care of the needs of that particular group. Each family had its own swimming pool. Each family in Phoenix probably has an evaporative-style aircooler which takes a little more water than some of the other types.

I was just trying to say the reason we are so concerned about this water supply is not only because it takes 150 gallons per day per person for domestic use, but that it takes 950 gallons per day per person to take care of the industrial and agricultural uses.

Mr. CALDWELL. That is true.

Senator ANDERSON. If we allow those industrial and agricultural uses to expand without proper conservation for our water supplies, then we are in deep trouble.

I will not guarantee the 1,100-gallon figures because I did not prepare it. If I had prepared it I would have known if it might be wrong. As it is I know there might be a possibility of it being wrong. I say it is somewhere in that neighborhood of 1,000 gallons per day per person.

Go ahead. The 150 figure bothered me and I got it straightened out in my mind. Thank you very much for your patience.

NEW TECHNIQUES IN MULTIPLE-PURPOSE RIVER MANAGEMENT

Mr. CALDWELL. The need for multiple purpose use of river waters to control water quality will become more and more important with the full development of river basins. This will be particularly true of the San Juan Basin in New Mexico.

EFFECTS OF NUCLEAR ENERGY

The effects of nuclear energy field are becoming more and more evident in relation to water pollution. This is evidenced by the Animas River survey of the Public Health Service, and the groundwater problems created in the Grants-Ambrosia Lake area. New Mexico's uranium ore reserves, milling capacity, and AEC installations are creating a continually growing problem in regard to the effects on municipal and industrial water supplies.

NEW TECHNICAL METHODS OF IMPROVING WATER SUPPLY

1. Improved ground water use can be obtained by the provision of more extensive ground water geology reports and the availability of current data on aquifers that are subject to heavy withdrawals.

2. The demand for ground water recharge is becoming more and more pronounced. Use of surface spreading for recharge has been in common use for some time, but the use of deep recharge wells directly connected to the aquifer is comparatively recent and is still confronted with many practical problems. The office of the State Engineer of New Mexico and the U.S. Geological Survey are jointly investigating these practical aspects near Lovington, in Lea County, N. Mex. Also, the Hagerman Irrigation Co., at Hagerman, N. Mex., is proposing a comprehensive deep well recharge program in the off-irrigation season, in order to stop encroachment of saline waters into this water basin in Chavez County. However, this problem is far from being solved, as surface water quality, sewage contamination, and turbidity of recharge waters present practical operational difficulties. The New Mexico Department of Public Health is actively interested in both these projects and others that have been attempted, as safety of domestic water supplies is closely associated with this method of recharge.

The conservation of all available waters in New Mexico for top priority and multiple use is vitally important in this water-deficient area. In this respect, treatment of sewage and industrial wastes for reuse of waters is a necessity. Under the Federal Water Pollution Control Act, Public Law 660 of the 84th Congress, 38 sewage-works projects have been initiated in New Mexico. This program of up to 30 percent Federal grants for construction purposes has been a definite stimulant in conservation of available waters in New Mexico, and it is important that it continues. A summary of the accomplishments under Public Law 660 is attached to this statement.

The problem of value of water and top priority of water is in conflict with the doctrine of prior rights to water use. In New Mexico, with full appropriation of waters in nearly all instances, water rights for municipal and industrial expansion must usually be obtained by purchase of other water rights. This is usually at the expense of agricultural interests, and is resulting in a reallocation of water uses for the expanding New Mexico economy.

Thank you, gentlemen.

Mr. Chairman, I have some additional information to be supplied for the record.

The CHAIRMAN. Without objection, it will be included in the record at this point.

(The information referred to follows:)

SUMMARY REPORT OF THE FEDERAL WATER POLLUTION CONTROL PROGRAM IN NEW MEXICO

On September 14, 1959, the New Mexico Department of Public Health was officially notified that the Public Health Service, through congressional appropriation, had awarded the State of New Mexico $614,275 in Federal grant construction funds for fiscal year 1960 under Public Law 660, the Federal Water Pollution Control Act. The State health department was also awarded $20,900 in administrative funds under this act. Since the inception of this program in July 1956, the State of New Mexico has been awarded $2,505,325 in construction grant funds and $82,258 for program administration.

Federal grant funds, under the act, are provided to aid muncipalities in the construction of sewage-treatment-plant facilities and interceptor sewers. Municipalities are required to pay 70 percent or more of the eligible project costs with Federal grant funds being used for as much as 30 percent of the project cost up to a maximum grant of $250,000 for any one project. The availability of these Federal funds has made New Mexico communities aware of the need and responsibility for the provision of adequate sewage treatment. Without grant funds many New Mexico communities would have found it very difficult, or impossible to obtain project financing or to sell revenue bonds. The allocation of Federal funds to some New Mexico towns has aided in obtaining a favorable response from the public toward general obligation bonds. However, the most important consideration is that domestic sewage, from New Mexico communities, receives adequate treatment. This program has met with great success in New Mexico; to the point that our State leads the Nation in providing adequate sewage treatment in sewered communities.

Federal grant funds are allocated to New Mexico municipalities by the Governor's advisory council on water pollution control. The advisory council meets each year to hear requests for these funds and to allot them on the basis of need and readiness to proceed with construction. On October 2, 1959, the advisory council met to review applications from New Mexico communities for fiscal 1960 Federal-grant funds. The funds available for allocation at this meeting included the fiscal 1960 grant funds of $614,275 and $22,172.72 carryover from fiscal 1959 moneys; or a total of $636,447.72. Requests for Federal funds were received at this meeting from six municipalities for eight new projects, and from two communities with active projects requesting additional grant funds. A summary of the requests received at this meeting and of the allocations of available grant funds, as made by the Governor's advisory council, are shown in table I. It may be seen from this table that requests for grant funds exceeded the available funds by more than $400,000. It will be noted that Santa Fe and Cimarron received no allocations. Community matching funds for Santa Fe will not be available until April 1960 when a G.O. bond election can be held. Cimarron stated that matching funds could not be obtained for some time to come and that their request should be held in abeyance. The town of West Las Vegas did not receive the entire amount requested as their request was an informal and unsubstantiated request, and the availability of community matching funds is indefinite.

To date, requests for funds have been received from New Mexico communities for 41 separate projects with Federal funds being allocated for 38 of these projects. Of these projects, 17 have been completed. A summary of the completed projects is shown in table II. At the present time there are 16 active projects in various stages of progress. A summation of the funds involved in these active projects is shown in table III. These 16 active projects do not include the 5 new projects which have received allocations from fiscal 1960 funds.

The total Federal grant funds allocated to active and completed projects, since the inception of this program, is approximately $2½ million. This program has stimulated construction of sewage-treatment works in New Mexico to an all-time high. The 38 active and completed projects which have been allocated Federal-grant funds, have resulted or will result in the expenditure of more than $12 million for water pollution control and the protection of the public health.

A brief outline of the work under each of the new, active, and completed projects is as follows:

WPC, NM–1, Gallup, N. Mex.

Work under this project was completed in April 1959. The total project cost was $217,192.12, of which the Federal Government provided $60,157.69. This project included the construction of a new interceptor sewer, a high-rate trickling filter, pump station, and new primary clarifier. These new plant units are currently in operation.

WPC, NM–2, Fort Sumner, N. Mex.

This was the first project under Public Law 660 to be completed in New Mexico. This project, which includes a complete new sewage-treatment plant, was completed in October 1957. The cost of these new works was $161,121. A Federal grant of $26,022 was received by the community.

WPC, NM–3, Santa Fe, N. Mex.

This project, to further enclose the effluent line from the Santa Fe treatment plant, was completed in October 1958. This work included 3,120 feet of 18-inch

sewer. The Federal Government contributed $4,514.15 to the cost of this project, out of a total project cost of $18,364.08.

WPC, NM–4, Albuquerque, N. Mex.

An expansion program in excess of $1 million for the sewage-treatment facilities at Albuquerque was included in this project. A connected population of 200,000 can now be adequately served by the enlarged plant. The new facilities have been completed and are now in operation. New units completed include an oil separator, emergency bypass for storm waters, new digesters, sludge-heating equipment, sludge beds, and sewage-gas powerplant (electric), primary and secondary clarifiers, and additional equipment for the treatment-plant laboratory. Albuquerque now has one of the finest sewage-treatment-plant laboratories in the Southwest. The Federal grant for this project was $250,000, that is the maximum allowable, and the total cost was $865,560 on the eligible portion of the work.

WPC, NM–5, Roswell, N. Mex.

The construction of 10,300 feet of 21-inch sewer line by the city of Roswell was completed in January 1958. This project has been the only force account project in New Mexico. The cost of construction was $77,787.21, which included the Federal grant of $22,887.15.

WPC, NM–6, Las Cruces, N. Mex.

Construction of new units at the Las Cruces sewage-treatment plant, a new lift station, and 15-inch interceptor sewer were completed in April 1959. The new work at the treatment plant included reconstruction of the existing trickling filter and construction of a new digester. The total estimated project cost was $252,252. The Federal grant allocation for this project was $56,722.

WPC, NM–7, Aztec, N. Mex.

The construction of a new sewage-treatment plant has been completed, and it is now in operation. It consists of a mechanical bar screen and grit chamber, primary clarifier, high-rate trickling filter, digester, secondary clarifier, and outfall line to the Animas River. The total construction cost of this project was $259,646.12, including $63,429 from Federal grant funds.

WPC, NM–8, Carrizozo, N. Mex.

The construction of a new sewage-treatment plant and sewer for the town of Carrizozo was completed in October 1957. The total estimated project cost was $57,746.17. A Federal grant of $15,844.18 was received by the community under the Public Law 660 program.

WPC, NM–9, Farmington, N. Mex.

Farmington received a Federal grant allocation of $16,871.14 and the total cost of this project is estimated at $56,237.14. This project includes a new lift station, force main, and interceptor. This work was completed in April of 1959.

WPC, NM–10, Grants, N. Mex.

The construction of a new sewage-treatment plant and outfall sewer in May of 1959 alleviated a serious public health hazard. This plant will provide complete treatment of the sewage both from the town of Grants and the village of Milan. The total project cost was $273,534.15 with Federal participation of $69,900.

WPC, NM–11, Espanola, N. Mex.

Espanola experienced some difficulty in obtaining project matching funds. Recently they have made arrangements for the State investment council to purchase a $100,000 bond issue to be backed by sales-tax revenue. Since the submission of the original application for a Federal grant, the scope of the eligible portion of the project has been increased. The estimated cost of the eligible portion of the project is now $54,643. The village of Espanola presented a request to the Governor's advisory council, at their recent meeting, for $5,000 in additional grant funds, making a total Federal grant of $15,548.30. The village project provides for the construction of an interceptor sewer and two lift stations in the Riverside area of Espanola. This is considered to be a very important project from a public health viewpoint.

WPC, NM–12, Ruidoso, N. Mex.

This project provides for an original sewage system and sewage-treatment plant for the village of Ruidoso. The total estimated project cost is $623,982.99 with an estimated cost of $424,319.07 for that portion of the project which is eligible for Federal participation. The Federal grant for this project is $120,164.40 with community matching funds of $503,818.59. This project is approximately 75 percent complete and should be finished in the near future.

WPC, NM–13, Carlsbad, N. Mex.

The construction of new plant units which included a lift station, pressure line, two high-rate trickling filters, and a secondary clarifier, has been completed by the city of Carlsbad. This project, completed in May of 1959, cost approximately $523,458.85, with the Federal Government contributing $156,681.34 to this project.

WPC, NM–14, Silver City, N. Mex.

The town of Silver City has recently completed the construction of a new sewage-treatment plant which consists of a bar screen, primary clarifier, trickling filter, final clarifier, digester, and sludge beds. The construction cost of this project was approximately $197,000, with a Federal grant of $59,100 being made to the community. Final project cost and Federal grant for this project are being computed by the Public Health Service.

WPC, NM–15, Bayard, N. Mex.

A new sewage-treatment plant designed for a connected population of 6,300 persons has been completed at a total estimated cost of $122,900. A Federal grant of $33,000 was allocated to the village of Bayard. The new plant consists of a bar screen, primary clarifier, trickling filter, pump station, digester, and sludge beds.

WPC, NM–16, Albuquerque, N. Mex.

This is Albuquerque's second Federal grant project, which includes the construction of 12 new sewage-chlorinating stations and the conversion of an existing chlorinating station from manual to automatic operation. The project was completed in April of 1959. The total eligible cost of this project was $129,988.33. The Federal grant is only $16,000 and not 30 percent of the project cost, as there were not sufficient Federal grant funds allocated to New Mexico to meet all grant requests.

WPC, NM–17, Alamogordo, N. Mex.

This project has been completed, and it is in operation. The cost of this project is estimated at $335,223, and the Federal grant was $90,000. The new units include a bar screen, primary clarifier, trickling filter, two digesters, sludge heating units, and pump station.

WPC, NM–18, Anapra, N. Mex.

Anapra is a small community in the southern part of New Mexico, located adjacent to the city of El Paso, Tex., on the Rio Grande. This community, of about 350 people, is incorporated as a Mutual Domestic Water Consumers' and Sewage Works Association. A Federal grant allocation of $1,800 has been awarded to aid the village in constructing an interceptor sewer, lift station, and force main with an estimated total project cost of $6,000. Sewage from Anapra will be pumped into sewers of the city of El Paso, Tex. An agreement between the city of El Paso, and the Anapara association has been signed. There is a possibility that this project will be expanded to eliminate adjacent water-pollution problems. This project will be started as soon as an El Paso city sewerline is constructed near the village.

WPC, NM–19, Cloudcroft, N. Mex.

Cloudcroft has completed the construction of a new sewage-treatment plant and interceptor sewer. A final inspection of this project was conducted on October 20, 1959. The construction grant allocated to this project is $25,000 and the total estimated cost is $88,636.46.

WPC, NM–20, Lovington, N. Mex.

This plant will provide both primary and secondary treatment and it consists of a bar screen, grit chamber, primary clarifier, secondary clarifier, digester, trickling filter, and sludge beds. The estimated total cost is $445,200 and the

Federal grant allocation for this project is $110,000. Construction of this plant was completed in April 1959.

WPC, NM–21, Milan, N. Mex.

Milan is a newly incorporated area about 3 miles west of the town of Grants, on the Rio San Jose. The village of Milan and the town of Grants have made an agreement whereby Grants will accept the sewage from Milan for conveyance and treatment. An interceptor sewer and two lift stations will be required to transmit sewage from the village of Milan to Grants. The estimated cost of this work is $163,501.96 and total Federal aid requested $49,050.59. Work on this project is approximately 50 percent complete.

WPC, NM–22, Santa Rosa, N. Mex.

Work to be included under this project consists of interceptor sewer lines and a sewage treatment plant that includes an Imhoff tank, trackling filter, final clarifier and sludge beds. The old plant is overloaded, and very little treatment is being given to the sewage, creating a potential health hazard in this area and for downstream water users. The Federal grant allocation for this project is $36,591.11, out of a total estimated cost of $128,697.88. A construction contract for this work has been let recently and construction of the project is getting underway.

WPC, NM–23, Farmington, N. Mex.

Farmington has requested a Federal grant for aid in construction of additional sewage treatment facilities, pumping stations, interceptors, outfall lines, and appurtenances. The total cost of this project is estimated to be $833,333. Under the construction grants program, the town of Farmington will receive a Federal grant of $245,000 to aid the community in the construction of adequate sewage treatment facilities for this rapidly expanding area. Contracts for the sewage plant equipment for the construction of the plant have been awarded and construction will begin in the near future.

WPC, NM–24, Bloomfield, N. Mex.

This project is necessary to prevent pollution of the San Juan River, which is an interstate stream flowing through the States of Colorado, New Mexico, and Utah. A Federal grant of $38,566.71 was allocated to the village of Bloomfield for aid in the construction of its first sewage treatment facilities and interceptor sewer in the community. The total project cost is esimated at $128,555. Contracts for the construction of the interceptor lines have been awarded and bids have been awarded and bids have been opened for construction of the sewage treatment plant.

WPC, NM–25, Albuquerque, N. Mex.

The city of Albuquerque has requested a maximum grant of $250,000 for aid in the construction of an interceptor sewer for the south side of the city to convey sewage to a proposed sewage treatment plant. The total estimated project cost is $1,344,200 with the city providing $1,094,200 of these funds from a general obligation bond issue authorized by the voters on October 6, 1959. This is an important project as Albuquerque is the largest city in the State and the greatest single contributor of sewage effluent to the Rio Grande in New Mexico.

WPC, NM–26, Hobbs, N. Mex.

Hobbs was allocated $20,145 as a Federal grant for aid in the construction of $67,150 in new additions to the sewage treatment plant which will include pump station renovations and other miscellaneous improvements as recommended by the New Mexico Department of Public Health. A contract for new plant equipment has been awarded and bids will be received in the near future for construction of plant improvements under this project.

WPC, NM–27, Capitan, N. Mex.

Capitan is situated on a tributary to the Rio Bonito that discharges into the Hondo River. The Hondo is a main tributary of the Pecos River which is an interstate stream. Its waters are used for irrigation, propagation of fish, and for other recreational purposes downstream. This project calls for the construction of an original sewage works in Capitan, and includes provision of a collection system, interceptors, and a treatment plant consisting of an Imhoff tank, trickling filter and oxidation ponds. The total cost of this project is estimated at $42,376.07 with the Federal share for this project being $12,712.82.

WPC, NM–28, Eunice, N. Mex.

Overloaded conditions are resulting in the creation of a public health hazard and nuisance problem at Eunice. The new facilities will consist of additions to the sewage treatment plant, including a second Imhoff tank, recirculation system for the trickling filter, sludge beds, and final effluent ponds. The Federal Government will contribute $38,700 to the cost of this project, of a total estimated construction cost of $129,000. Bids were opened on October 28, 1959, for this project.

WPC, NM–29, Clovis, N. Mex.

Clovis is planning to expand and remodel the existing sewage treatment plant through construction, repairs, and enlargements. Primary treatment facilities are overloaded and numerous repairs are urgently needed at the plant. A grant of $36,000 has been allocated to Clovis. The total estimated cost of the proposed work is expected to be $120,000.

WPC, NM–30, Las Cruces, N. Mex.

This project will contribute to the control of pollution of the Rio Grande River. Sewage discharges into the river create a potentially serious health hazard to downstream water supplies. The work included in this project consists of additions and modifications to the sewage treatment plant, pump station renovations, and an additional interceptor sewer. The city of Las Cruces will receive a Federal grant of approximately $43,947 as a part of a total project cost of approximately $146,490. Plans and specifications for this work are expected to be completed in the next month or two.

WPC, NM–31, Gallup, N. Mex.

Control of pollution in the Rio Puerco of the West, is essential to the health and well-being of downstream residents. Downstream communities use this stream for irrigation, recreation, and domestic water supply purposes. This project consists of additions to the sewage treatment plant, including primary clarifier, and sludge beds. The estimated cost of this project is $127,680, with a Federal grant of $38,304. Plans for this project have been approved and a contract for the new work will be let in February or March.

WPC, NM–33, Raton, N. Mex.

This project is proposed as a force account project and is one of the few force account projects under the construction grants program. The city of Roswell was allocated a Federal grant of $83,500 for the construction of an interceptor sewer and plant additions. These additions will include a clarifier and trickling filter. The total cost of this project is estimated to be $279,000. The effluent discharges to an interstate stream, the Pecos River, which received extensive use for irrigation, recreation, and industrial purposes.

WPC, NM–33, Raton, N. Mex.

There is no sanitary sewer in the area concerned, as all dwellings use septic tanks, cesspools, or privies. This project covers the construction of a sanitary sewer interceptor to this area. Federal participation is $11,128.86 and the estimated total cost is $38,19.95. Preliminary work on the project plans have been made with construction plans to be completed by January or February.

WPC, NM–34, Los Lunas, N. Mex.

The original Federal grant request for Los Lunas was for $3,430 of fiscal 1959 grant funds. The project has been enlarged and $27,824.56 in additional fiscal 1960 funds was requested. The Federal grant allocation for this project is now $31,254.56 with the estimated total project cost at $104,181.88. The work to be included in this project is a new interceptor sewer and the construction of a new sewage treatment plant to provide adequate treatment of municipal wastes before being discharged to the Rio Grande River.

WPC, NM–35, Artesia, N. Mex.

The existing sewage plant at Artesia is overloaded and does not provide adequate secondary treatment. The city plans to construct a new treatment plant some distance away from the community. This plant will provide complete treatment and will be a high-rate trickling filter plant. The estimated project cost is $300,000 with the community providing $210,000 and the Federal grant for this project being $90,000. Revenue bond funds will be used to finance this project.

WPC, NM–36, Cimarron, N. Mex.

The village of Cimarron has an adequate septic tank that is heavily overloaded. The existing outfall sewer is a 6-inch line. The village proposes to construct a new sewage treatment plant, an interceptor sewer, and lift station. The estimated project cost is $42,150 with the community providing $30,000 of these funds, with the Federal funds providing the difference, or $12,850. Because of financial difficulties, matching funds for this project will not be available for some time to come; therefore, no Federal grant allocation was made to Cimarron at the recent meeting of the advisory council.

WPC, NM–37, New Mexico State University

Recent construction of married-student housing and growth of the State university has caused severe overloading of the sewage treatment plant at the school. The university plans to construct an interceptor sewer to carry a portion of the wastes from the college plant to a connection to the city of Las Cruces sewage system. An agreement between the city of Las Cruces and the State university will be worked out to provide for treatment of these wastes.

WPC, NM–38, Santa Fe, N. Mex.

The city of Santa Fe has experienced a great deal of difficulty with odors from their existing plant which is located near a residential area. Certain units of the existing plant are now overloaded. The city plans to construct a new plant to provide treatment for the expected 1970 population. The estimated cost of this work is $1,522,840 with the community providing $1,272,840 and a maximum Federal grant of $250,000 for the balance of the project cost. As matching funds are not available, no grant was made for the 1960 fiscal year.

WPC, NM–39, Albuquerque, N. Mex.

The present sewage treatment plant for the city of Albuquerque is capable of providing treatment for a connected population of 200,000. The population now served by the city sewerage system is estimated to be 185,000 people. In order to provide for the anticipated growth of the city, a new treatment plant, south of the existing plant, is proposed. This plant would provide complete treatment for a connected population of 100,000, or a total capacity for both plants of 300,000. Albuquerque has requested a maximum grant of $250,000 to aid them in construction of this plant with an estimated total project cost of $3,068,814. The city will provide the balance of the project funds from a general obligation bond issue. A grant of $240,000 was allocated by the advisory council on October 2, 1959.

WPC, NM–40, Town of West Las Vegas, N. Mex.

The town of West Las Vegas has requested a Federal grant for reconstruction and additions of certain units at the sewage treatment plant. The sludge beds at this plant are subject to flooding. The trickling filter needed renovations and a final clarifier or oxidation pond is needed. The Governor's advisory council has allocated $5,000 in Federal grant funds to the town of West Las Vegas to help get a project to accomplish this work underway.

WPC, NM–41, Santa Fe, N. Mex.

Santa Fe plans to construct an interceptor sewer from the present treatment plant to an area south of the community where a new plant is to be constructed. The estimated project cost is $538,160.10, with the community providing $376,712.56. Santa Fe has requested a Federal grant of $161,448.24 for this project, but as sufficient Federal funds were not available to meet all applications, the advisory council set aside this request until the next fiscal year with the recommendation that this project be given high priority for 1961 grant funds. No matching funds are available now.

As will be noted in table I, $9,600 has been set aside by the Governor's advisory council as Federal matching funds to aid small, unincorporated communities in constructing sewage disposal facilities under the New Mexico Sanitary Projects Act. This act, passed by the State legislature in 1957, provides for State assistance up to $12,000 for any one project in the construction of sewerage systems and sewage treatment facilities in rural communities. For example, a village with 40 participating families could receive $250 per family or $10,000 in State funds. The community is then required to furnish labor, materials, or cash in an amount equal to one-third of the State funds, or in this case

$3,333.33. This would mean a total community-State contribution of $13,333.33. A Federal grant of 30 percent of the eligible portion of the project may then be obtained. If all of the costs of the project could be made eligible for Federal participation, a Federal grant of $5,714.28 could then be obtained, and the total project funds would be $19,047.61. A number of small villages have shown interest in this program, and a few possible projects would be Glorieta, Dixon, Mora, San Rafael, and Organ. The New Mexico Department of Public Health hopes to initiate at least three projects under this act during the fiscal 1960 year.

The Federal Water Pollution Control Act also provides administrative procedures for the investigation and abatement of pollution originating in one State and causing an undesirable situation in another State. The act provides for a conference between the States concerned, the Public Health Service, and other interested agencies to review any suspected pollution and to arrive at a solution to any common pollution problems through joint cooperation. On April 29, 1958, the State of New Mexico at just such a conference, requested that the Public Health Service make a study of the Animas River with regard to pollution of this stream by industrial and municipal waste originating in the State of Colorado. On June 24, 1959, the results of this study were presented at a meeting of the second session of the conferees.

The Public Health Service found that wastes discharged from a uranium mill at Durango, Colo., were deleteriously affecting public water supplies at Aztec and Farmington, N. Mex., and individual water supplies on farms and ranches that take water from the Animas River in New Mexico. Certain nonradioactive chemical wastes discharged by this uranium mill were found to be toxic to fish and aquatic life in the Animas River.

The participants in this conference recognized the efforts of the milling company concerned to abate their pollution of the Animas River. The participants stipulated that the following action be taken by the mill by October 24, 1959:

(*a*) Install treatment facilities which will reduce discharge of toxic materials deleterious to fish and aquatic life so that these materials will no longer be discharged into the Animas River in quantities harmful to fish and aquatic life.

(*b*) Install facilities which will substantially remove all settleable solids in order to reduce radioactive discharges to the Animas River.

(*c*) Install facilities which will treat the remaining radioactive material in solution in the plant effluent by the barite filter process (or a modification thereof or an equivalently effective process) to reduce such remaining soluble radium content of the effluent by at least 70 percent.

As soon as practicable after October 24, 1959, representatives of the Public Health Service and the State water pollution control agencies of Colorado and New Mexico will make a joint investigation and evaluation of the remedial efforts put into effect by the uranium mill and report their findings of this investigation to the conferees and other interested persons.

The funds made available to the State of New Mexico under the Federal Water Pollution Control Act have become an essential part of the future plans of New Mexico communities in their construction of sewage treatment facilities. Communities are looking ahead to future growth anticipating that these funds will be available for the next 6 years. Appropriation of funds for this program must be made each year by Congress.

The program administrative funds awarded New Mexico each year make possible the establishment and maintenance of adequate measures for the prevention and control of water pollution in the State. Without these funds, much of the work carried on by the New Mexico Department of Public Health in this area would not be possible.

Appropriation of these funds will end next year. It is very important that amendments be made in the Water Pollution Control Act to provide continuation of these funds for at least the next 6 years. Support of this program by local and State civic groups is of great help in advising Congress of the need for continuing the program by annual appropriation of these funds.

TABLE I.—*Communities applying for Federal grant under Public Law 660—1960 fiscal funds*

Community	Project No.	Fiscal 1960 Federal grant funds requested	Communities allocated Federal grant funds by the advisory council at Oct. 2, 1959, meeting	Total estimated project funds for fiscal 1960 projects
Espanola [1]	WPC, NM–11	$5,000.00	$5,000.00	[2] $54,643.00
Albuquerque	WPC, NM–25	250,000.00	250,000.00	1,344,200.00
Los Lunas [1]	WPC, NM–34	27,824.56	27,824.56	[2] 104,181.88
Artesia	WPC, NM–35	90,000.00	90,000.00	300,000.00
Cimarron	WPC, NM–36	12,850.00		
New Mexico State University	WPC, NM–37	9,016.42	9,016.42	30,054.75
Santa Fe	WPC, NM–38	250,000.00		
Albuquerque	WPC, NM–39	250,000.00	240,000.00	3,068,814.00
West Las Vegas	WPC, NM–40	15,000.00	5,000.00	
Santa Fe	WPC, NM–41	161,448.24		
Sanitary Projects Act		9,600.00	9,600.00	
Total		1,080,739.22	636,440.98	4,901,893.63

[1] Active projects requesting additional grant funds.
[2] Figures also included with active projects.

TABLE II.—*Completed projects under the Federal Water Pollution Control Act*

Community	Project No.	Federal grant funds	Community matching funds [1]	Total eligible project cost	Estimated total project cost	Approximate date of completion
Gallup	WPC, NM–1	$60,157.69	$157,034.43	$217,192.12	$217,192.12	April 1959.
Fort Sumner	WPC, NM–2	26,022.00	135,099.00	86,740.00	161,121.00	October 1957.
Santa Fe	WPC, NM–3	4,514.15	13,849.93	18,364.08	18,364.08	October 1958.
Albuquerque	WPC, NM–4	250,000.00	812,600.00	865,560.00	1,062,600.00	Do.
Roswell	WPC, NM–5	22,887.15	54,900.05	77,787.21	77,787.21	February 1958.
Las Cruces	WPC, NM–6	56,772.00	195,480.00	252,252.00	252,252.00	April 1959.
Aztec	WPC, NM–7	63,429.00	196,217.12	259,646.12	259,646.12	December 1958.
Carrizozo	WPC, NM–8	15,844.13	41,902.04	52,813.78	57,746.17	October 1957.
Farmington	WPC, NM–9	16,871.14	39,366.00	56,237.14	56,237.14	April 1959.
Grants	WPC, NM–10	69,900.00	203,634.15	273,534.15	273,534.15	May 1959.
Carlsbad	WPC, NM–13	156,681.34	366,777.85	523,458.85	523,458.85	Do.
Silver City	WPC, NM–14	[2] 59,100.00	[2] 137,900.00	[2] 197,000.00	[2] 197,000.00	October 1959.
Bayard	WPC, NM–15	33,000.00	89,900.00	122,900.00	122,900.00	April 1959.
Albuquerque	WPC, NM–16	16,000.00	113,988.33	129,988.33	202,730.83	Do.
Alamogordo	WPC, NM–17	90,000.00	245,223.00	335,223.00	335,223.00	Do.
Clouderoft	WPC, NM–19	[2] 25,000.00	[2] 63,636.46	[2] 88,636.46	[2] 88,636.46	October 1959.
Lovington	WPC, NM–20	110,000.00	335,200.00	445,200.00	445,200.00	April 1959.
Total		1,076,178.60	3,202,708.02	4,002,533.24	4,351,629.13	

[1] Based on total estimated project cost.
[2] Estimates as final projects costs are not available.

TABLE III.—*Active authorized Federal grant projects*

Community	Project No.	Current allocation of Federal grant funds	Community matching funds	Estimated eligible cost of project	Total estimated project cost
Espanola	WPC, NM-11	[1] $15,548.30	$39,094.70	[2] $54,643.00	$54,643.00
Ruidoso	WPC, NM-12	120,164.40	503,818.59	424,319.07	623,982.99
Anapra	WPC, NM-18	1,800.00	4,200.00	6,000.00	6,000.00
Milan	WPC, NM-21	49,050.59	114,451.37	163,501.96	163,501.96
Santa Rosa	WPC, NM-22	36,591.11	152,500.00	128,697.88	189,091.11
Farmington	WPC, NM-23	245,000.00	588,333.00	833,333.00	833,333.00
Bloomfield	WPC, NM-24	38,566.71	147,133.93	128,555.00	185,700.64
Hobbs	WPC, NM-26	20,145.00	47,005.00	67,150.00	67,150.00
Capitan	WPC, NM-27	12,712.82	103,863.25	42,376.07	116,576.07
Eunice	WPC, NM-28	38,700.00	90,300.00	129,000.00	129,000.00
Clovis	WPC, NM-29	36,000.00	84,000.00	120,000.00	120,000.00
Las Cruces	WPC, NM-30	43,947.00	102,543.00	146,490.00	446,490.00
Gallup	WPC, NM-31	38,304.00	89,376.00	127,680.00	127,680.00
Roswell	WPC, NM-32	83,500.00	195,500.00	279,000.00	279,000.00
Raton	WPC, NM-33	11,128.86	27,291.09	38,419.95	38,419.95
Los Lunas	WPC, NM-34	[1] 31,254.56	72,927.32	[2] 104,181.88	104,181.88
Total		822,413.35	2,362,337.25	2,793,347.81	3,184,750.60

[1] Includes increases in Federal grants from fiscal 1960 allocations. (See table I.)
[2] These figures are also shown in table I.

The CHAIRMAN. I would like to ask a question.

With reference to the operation of the Federal Water Pollution Control Act here in New Mexico what has been the response of your community for participation in this?

Mr. CALDWELL. It has been excellent. They came right through.

The CHAIRMAN. Has there been enough money allocated under the program as it is now written to meet all of the requests for participation that have come to your office from your local municipalities?

Mr CALDWELL. Just about.

The CHAIRMAN. Just about?

Mr. CALDWELL. We average about $10,000 one way or the other.

The CHAIRMAN. Thank you.

Mr. CALDWELL. Surely.

Senator ANDERSON. Mr. Caldwell, let me say that I was interested and participated in the setting up of the first State department of health and brought Mr. Gray out here.

Mr. CALDWELL. Harold Gray?

Senator ANDERSON. He was the first man and he came in about 1921. I would not want that to indicate how old I am. In any case we brought him out here and thought he had done very good work. This paper here today persuades me that you are doing that very fine work, and I compliment you on it.

Mr. CALDWELL. Thank you very much, Senator.

Harold Gray is retired from the University of California and doing private practice.

Senator ANDERSON. We borrowed two other doctors, Dr. C. E. Walker and Dr. G. S. Luckett. We could not borrow one when we got down to Mr. Gray. We had to hire him. He has done a fine job.

Mr. CALDWELL. Thank you.

Senator ANDERSON. I think we should get the report of the Army Corps of Engineers before Senator Kerr leaves.

Would General Whipple of the division office in Dallas please come forward.

STATEMENT OF BRIG. GEN. WILLIAM WHIPPLE, DIVISION ENGINEER, SOUTHWEST DIVISION, CORPS OF ENGINEERS, DALLAS, TEX.

General WHIPPLE. I am Brig. Gen. William Whipple, Division Engineer, the Southwest Division, Corps of Engineers, Dallas, Tex. We are represented in New Mexico by several districts, but the principal one is our Albuquerque District with Colonel Reed who is here today.

The interest of the Corps of Engineers in this area primarily is flood control. This must be related, of course, to other consumptive water uses and extends to both reservoir and local potential projects.

Of outstanding importance to the program of the Corps of Engineers is the development in the Rio Grande Valley where we have at the present time authorized developments including some reservoir storage and floodway. Levees of the floodway in the vicinity of Albuquerque have been constructed while those in the valley are just getting started this year. It is, however, essential that the reservoir flood control plan be completed as already referred to by Mr. Reynolds in the State of New Mexico.

We have a review report which has finally been coordinated with the various States concerned and with the other users of water. This report, including a recommendation of construction of the Cochiti Reservoir and the Galisteo Reservoir is currently in the hands of the States for their comments to the Chief of Engineers. This has been made public and so far construction does appear to be favorably indicated and extremely necessary, in fact, to solve a very dangerous flood control situation in the Rio Grande Valley.

We have other smaller interests in flood control in other projects of which perhaps the most interesting this year is the two-rivers project in the Pecos watershed near Roswell, for which construction funds have just been appropriated. We expect to start construction on this project later this fiscal year.

The Corps of Engineers has other interests, particularly in local flood control projects and authorized survey investigations, but to save the time of the committee we have made a progress report applicable to the State of New Mexico projects and I will be happy to turn that over in two copies for the record.

Senator ANDERSON. Thank you, General.

(The information referred to follows:)

U.S. ARMY ENGINEER DISTRICT, ALBUQUERQUE,
CORPS OF ENGINEERS,
Albuquerque, N. Mex., November 12, 1959.

STATUS OF AUTHORIZED PROJECTS AND INVESTIGATIONS FOR FLOOD CONTROL AND ALLIED PURPOSES IN RIO GRANDE AND CANADIAN RIVER BASINS IN NEW MEXICO

RIO GRANDE WATERSHED

The Corps of Engineers water resources development program was initiated in 1943 in the Rio Grande watershed in accordanced with section 4 of the Flood Control Act of 1941. A comprehensive plan of improvement was formulated for the basin in cooperation with the interested States and other Federal agencies. A report thereon is published as House Document No. 243, 81st Congress, 1st session. The plan was authorized in part by the Flood Control Act of 1948. This act provided specifically for flood and sediment control reservoirs on Jemez

River and the Rio Chama; a floodway through the Espanola and Middle and Lower Valleys of the Rio Grande; and a floodway on Bluewater Creek near Grants. The Jemez Canyon Dam on Jemez Creek has been completed and construction is underway on Abiquiu Dam on Rio Chama and the Rio Grande floodway.

Many additional flood problems have been brought to the attention of Congress since 1948. The cities of Santa Fe, Albuquerque, Socorro, and Las Cruces have experienced severe damage from flash floods on tributary streams. Congress has authorized survey investigations in each locality. Surveys and reports thereon have been completed for both Albuquerque and Socorro and flood control improvements have been authorized for construction by the Flood Control Acts of 1954 and 1958, respectively. Funds have been appropriated for construction of the local protection project at Albuquerque but construction is contingent upon local interests furnishing the necessary rights-of-way for construction of the project. Preconstruction planning is underway for the flood control project at Socorro with funds made available in fiscal years 1959 and 1960. Surveys for flood control are presently underway with funds made available in fiscal year 1960 at Las Cruces and a report thereon is scheduled for completion in fiscal year 1961, provided additional funds are made available.

At the request of local interests, the U.S. Senate Committee on Public Works by resolution adopted June 28, 1956, requested a review of the original report on "Rio Grande and tributaries in New Mexico" (H. Doc. 243) to reanalyze the overall plan for flood control in the basin in consideration of present economic development. Local interests have stated that to provide the degree of protection warranted in the Middle Valley, particularly in the vicinity of Albuquerque where there has been a large increase in development during recent years, additions to the authorized plan of improvement are urgently needed. In consideration of this serious problem and in partial compliance with the Senate resolution, an interim report on the main stem of Rio Grande above Elephant Butte Dam has been prepared by the Corps of Engineers and was recently submitted by the Chief of Engineers to the affected States and interested Federal agencies for official review and comment, after which it will be submitted to Congress. This report recommends the construction of Cochiti Dam on Rio Grande in lieu of the authorized Low Chamita Dam and the Galisteo Dam of Rio Galisteo, tributary of Rio Grande. Additional interim reports on other problem areas will be prepared including Rio Chama above Abiquiu Dam; Jemez River above Jemez Dam; Rio Santa Cruz at Espanola; Rio San Jose at Grants; Rio Ojo Caliente; Embudo Creek; Rio Puerco and Rio Salado; tributary arroyos at Truth or Consequences, Bernalillo, Belen, Los Lunas, and Anthony, N.Mex. These outstanding investigations for flood control and allied purposes are estimated to cost $436,500.

PECOS RIVER WATERSHED

In accordance with provisions of the Flood Control Acts of 1938, 1939, and 1950, three survey reports have been completed and submitted to Congress for authorization of improvements for flood control and allied purposes on Pecos River and tributaries in New Mexico. Congress by the 1954 and 1958 Flood Control Acts authorized the construction of four flood control improvements on Pecos River in New Mexico—namely, Los Esteros and Alamogordo Reservoirs project on the main stem. Two Rivers Reservoir on Rio Hondo, the Artesia diversion channel on Eagle Creek, and the Dark Canyon floodway at Carlsbad.

Construction funds have been appropriated for the project at Artesia but construction has not been stated due to inability of local interests to furnish necessary rights-of-way. Funds also have been made available for preconstruction planning of the project of Carlsbad. Preconstruction planning on this project has been initiated but further planning is not scheduled because of inability of local interests to furnish necessary assurances of local cooperation. Funds made available for both of these projects have been revoked and they have been classified as inactive projects.

The Los Esteros and Alamogordo Reservoirs project has been in the preconstruction planning stage since fiscal year 1956. Planning has been prosecuted on a curtailed basis pending the completion of negotiations by the State of New Mexico for transfer of irrigation storage from the existing Alamogordo Reservoir to the proposed Los Esteros Reservoir. Unless assurances regarding the transfer of irrigation storage as stipulated by the authorizing legislation are furnished by the State of New Mexico by January 1, 1960, it is planned to sus-

pend the planning work and issue a notice to the State of New Mexico of the 5-year limitation on the authorization in accordance with section 201 of the Flood Control Act of 1954.

Construction of the Two Rivers Reservoir project on Rio Hondo at Roswell will be initiated with funds made available for fiscal year 1960, and will be continued in accordance with future appropriations.

As a result of the disastrous floods which occurred in the Pecos River Basin in 1954, a review of reports previously submitted on Pecos River and tributaries was directed by the Flood Control Act of 1954 to determine the advisability of improvements for flood control on Rio Hondo and tributaries including North Spring River and South Berrendo Creek in the vicinity of Roswell, and Rio Felix and tributaries. In addition, the U.S. Senate Committee on Public Works, by resolution adopted in 1957, requested further review of the report on Pecos River and tributaries to determine the advisability of improvements for flood protection along the main steam and tributaries of the Upper Pecos River Basin at and in the vicinity of Las Vegas, N. Mex. These outstanding investigations for flood control are estimated to cost $125,000.

CANADIAN RIVER BASIN

Conchas Dam is the only project constructed by the Corps of Engineers in the Canadian River Basin in New Mexico. There are no projects under construction and none are authorized.

Investigation of the flood problems in this basin were made in connection with the Arkansas-White-Red River Basins report published as Senate Document No. 13, 85th Congress, 1st session. The findings at that time were negative with respect to improvements for flood control. In addition, an unfavorable review report on preliminary examination of advisability of modifying the Conchas Dam project on Canadian River (by installation of spillway crest gates) was submitted in January 1954, in response to the resolution by the Committee on Public Works of the House of Representatives, United States, adopted July 3, 1953.

Outstanding is the resolution of the U.S. Senate Committee on Commerce adopted in 1945, requesting a review of the "Report on Arkansas River and Tributaries," House Document No. 308, 74th Congress. This investigation and report thereon is estimated to cost $15,000 and will pertain principally to investigations for flood control at Mora and Raton, N. Mex.

TULAROSA CLOSED BASIN

An increasingly serious flood problem at Alamogordo is caused by storm runoff which descends from the western slope of the adjacent Sacramento Mountains and converges upon the city as sheet flow. In years past the damage was not too serious because local interests were able to divert the waters away from the developed areas; however, during recent years the city has experienced rapid growth and has expanded into unprotected areas. The flood problem is now of such proportions as to be beyond solution by local interests. Congress, therefore, has authorized an investigation to determine the advisability of improvements by the Federal Government. As an initial step in the survey, a public hearing was held at Alamogordo in November 1958 to give local interests the opportunity to express their needs and desires as to required improvements and to submit data on past floods and damages. The survey report on flood control at Alamogordo and vicinity is scheduled for completion during 1961 and it is estimated that the investigation can be completed for $24,100.

SUMMARY

The Corps of Engineers is engaged in an important water resources program in New Mexico. Two projects have been completed and are now in operation. These are Conchas Dam and Reservoir on the Canadian River and Jemez Canyon Dam and Reservoir on the Jemez River, a tributary of the Rio Grande. Two major projects are under construction at the present time. These are the Abiquiu Dam on Rio Chama, a tributary of the Rio Grande, and the Rio Grande floodway. The portion of the Rio Grande floodway designed to afford protection to the city of Albuquerque and its environs has been completed. Preconstruction planning is underway for several other flood control projects in the State and for some of them has reached an advanced stage which would allow construction to be started in the near future, other considerations permitting. Also, a number

of surveys have been authorized to investigate the feasibility of additional improvements for the prevention of flood damages in New Mexico. Completion of the projects under construction, detailed design of authorized projects, and comprehensive planning for future water resources development in New Mexico will proceed in accordance with congressional authorization and appropriations.

The total estimated cost of the outstanding investigations in the Canadian River Basin and the Rio Grande Basin including the Pecos River watershed and the Tularosa closed basin is $600,600. During the period 1943–59, allotments for investigations in these basins have averaged about $60,000 annually. On this basis, approximately 10 years will be required to complete the authorized investigations and studies. These investigations will provide comprehensive information on the major flood damage areas in New Mexico, and the extent and character of improvements needed through the year 1980 for flood control and allied purposes including water conservation, major drainage, hydroelectric power, domestic and industrial water supply, pollution abatement, and fish and wildlife and recreational development.

Senator ANDERSON. I mentioned a minute ago this work on the eastern part of the State. We were hopeful that we might get some help in assisting the State of New Mexico to plan for a dam along the Canadian River. Does your group have some interest in that and might it be able to help, do you think, if such construction is authorized?

General WHIPPLE. We do have certain surveys authorized, but as regards the possibility of Federal assistance in the State project which I believe is the question you have in mind, I do not know that the Department has taken a position.

Senator ANDERSON. General, the Small Projects Act, for example, allowed the State engineers to go ahead with the reclamation projects up to about $5 million.

General WHIPPLE. Yes, sir.

Senator ANDERSON. While that did not completely solve all the problems of the world, it did take from the Bureau of Reclamation a large burden of work which it had to do heretofore to aid small areas which said, "We have a project. It is a little project, but we would like to have you come out and look at it."

The Bureau of Reclamation has assisted by reviewing plans and so forth that the State engineers developed just to be sure that two sets of eyes look at them.

Now, Mr. Reynolds has a problem in getting ready these dams along the Canadian River which instead of asking for complete Federal assistance we might build with State revenue bonds. I merely ask you, and I am not trying to commit you on a policy, you certainly need not answer if you do not wish to, whether you think it might not be desirable for the Bureau to review some of the data upon which the State engineer's data is based so the State might go ahead with the construction of the dam itself and not burden the Federal Government..

General WHIPPLE. We would be happy to cooperate in that, sir, and on flood control involved in this reservoir it would appear appropriate that we could lend some assistance.

Senator ANDERSON. Have you reported on Senator Chavez' bill which does involve cooperation in studies for flood control?

General WHIPPLE. That I do not know, sir, whether it has been reported. I will get the answer and have it put in the record.

Senator ANDERSON. Can you tell us of the status of planning on the Rio Puerco and Rio Salado for sediment control?

The Rio Puerco has a sediment problem that bothers people. We thought there might be an engineering study on that.

General WHIPPLE. I am not aware of that. Perhaps Colonel Reed may have information on that.

Senator ANDERSON. Colonel Reed, could you help us on that at all?

COMMENTS OF COL. ALBERT R. REED, DIVISION ENGINEER, CORPS OF ENGINEERS, ALBUQUERQUE DIVISION, ALBUQUERQUE, N. MEX.

Colonel REED. Senator Anderson, there is an authorized survey on the Rio Puerco and Rio Salado but no funds appropriated yet to carry out the studies.

Senator ANDERSON. When was the authorization passed? Do you recall?

Colonel REED. No, sir; I do not. I will probably have to call on somebody else. If Mr. Redmond will come up he may remember that.

Senator ANDERSON. This is again, I say, the motto of our State: "We enlarge the party as we go along."

The CHAIRMAN. Apparently this is one of the many projects being held up because of certain policies of no new starts of appropriations, Senator.

Senator ANDERSON. It could be a decided one.

General WHIPPLE. I think that is more a question of limitation of appropriations for surveys and investigations which also has held things up sometimes.

The CHAIRMAN. That limitation is due entirely to the attitude of the Bureau of the Budget about limiting operations that would be productive of new starts, General.

COMMENTS OF JAMES L. REDMOND, OF THE ALBUQUERQUE DIVISION OF THE CORPS OF ENGINEERS

Mr. REDMOND. The Corps of Engineers is authorized to review the report on the Rio Grande. That was authorized by the U.S. Senate committee resolution adopted June 28, 1956.

Senator ANDERSON. 1956. If the situation was bad in 1956 it is probably still bad in 1959. I am just wondering what the State might do to help implement this authorization to Congress, to get a study of sediment control on the Rio Puerco and the Rio Salado.

Do we need something special or is that official authorization sufficient.

General WHIPPLE. The official authorization is sufficient for that purpose, sir. It is a question of there being——

Senator ANDERSON. The funds are not sufficient?

General WHIPPLE. Funds have not been available for that purpose.

The CHAIRMAN. By the Congress.

General WHIPPLE. By the Congress? Yes, sir.

Senator ANDERSON. I am sure the senior Senator from New Mexico and senior Senator from Oklahoma will give that matter increasing attention very shortly. You recognize the importance of this particular piece of work.

General WHIPPLE. Yes, sir.

Senator ANDERSON. Do you have any other comments on the status of projects that are under construction or authorized?

You have mentioned the Cochiti Dam.

Colonel, how is the work at Cochiti coming along?

Colonel REED. Do you mean Abiquiu study of the Cochiti?

Senator ANDERSON. The Abiquiu is doing nicely. Cochiti is another step.

Colonel REED. The Middle Rio Grande report has been submitted and approved by the Board of Rivers and Harbors and in the Chief's office at the present time.

The comments from the various States and other Federal agencies are being submitted for inclusion in the record. It should be ready for submission to Congress in the near future.

Senator ANDERSON. Those items are of great interest to our people out here of course.

Thank you, General Whipple, Colonel Reed, and Mr. Redmond for being here today.

Senator ANDERSON. I earlier called the name of Paul Jones. I understand Mr. Gorman is here from the Navajo Tribe. Will you come forward, Mr. Gorman, please.

I was at the Navajo Reservation at the last intertribal meeting. I must say that they set a model for everybody the way they conducted their business.

We are glad to have you this morning.

STATEMENT OF HOWARD W. GORMAN, MEMBER OF THE NAVAJO TRIBAL COUNCIL OF THE NAVAJO TRIBE OF INDIANS

Mr. GORMAN. Thank you.

Mr. Chairman and members of the committee, my name is Howard W. Gorman and I am a member of the Navajo Tribal Council and present this statement on behalf of the the Navajo Tribe of Indians.

The population of the Navajo Tribe has increased from 19,000 in 1869 to approximately 90,000 today. Our rate of population increase is somewhere between 2.25 and 3.1 percent per year. The Navajo Indian Reservation, exclusive of district 6, which is now used by Hopis, contains about 14,500,000 acres. In addition, we Navajos have the use of 1,264,488 acres of land held under various tenures outside our reservation. By means of tribal purchases, we are steadily increasing our landholdings, but it is impossible to keep up with the increase in our population.

Our population density is much higher than the rest of the western rangelands, but by the standard populous areas of the world, it is low, being about one person for every 188 acres. However, it takes an average of about 28 acres of our land to support one sheep. Thus, if our reservation was stocked with sheep to capacity, and each Navajo owned an equal number, there would be 6½ sheep per person. This is obviously not enough to live on.

While raising livestock is still the way many of our people make their living, particularly old and illiterate people who have no other skills, it has long since ceased to be our principal means of livelihood.

Our experience is not unique; all over the world as population density increases the people have had to seek new ways of making a liv-

ing. When population density is very low people can live well hunting and fishing, but when the population increases they must turn to raising livestock. After a time more intensive land use becomes necessary to support the increased population and people must take up farming and finally industry.

Certainly it is possible to support far more than 90,000 people at a decent standard of living on 15,500,000 acres of land. Our problem can and will be solved by developing farmland and industries.

Water is the key to the problem.

Fortunately, plenty of water is physically available on our reservation from the San Juan River, and we have the legal rights to as much as we will need in the foreseeable future. The water must be applied to the land for irrigation and made available for the sites for the industries.

First, I will tell you about the agricultural development that is necessary and feasible in our country. The Navajo-Hopi Rehabilitation Act of 1950, authorized the appropriation of $9 million over a 10-year period in the hope of ultimately providing about 58,000 acres of irrigated land on our reservation. Through fiscal year 1959, $4,966,024 was appropriated and 5,050 acres of new land have been brought under irrigation. This development has been far too slow. It is indeed debatable if the Federal Government has saved anything by penny-pinching in this regard, because the lack of irrigated land has increased the necessity for relief payments and prevented the concentration of population which would reduce the cost of education and other community services.

We believe that exclusive of the Navajo irrigation project, 24,936 acres of additional farmland on our reservation can feasibly be brought under irrigation.

By the Colorado River Storage Project Act of 1956, construction of the Navajo Dam on the San Juan River in New Mexico upstream from our reservation was authorized, and the dam is now under construction. The reason for the existence of this dam is to provide water storage for the proposed Navaja irrigation project, which will consist of a net area of 110,630 acres of irrigated land solely for Navajo Indian use.

This project will provide a decent living for at least 17,000 Navajo Indians. That is a conservative estimate. Nevertheless, the Navajo Indian irrigation project has not yet been authorized by Congress. This should be done as soon as possible. For further details of this project, the committee is referred to the report of the hearings before the Subcommittee on Irrigation and Reclamation of the Committee of Interior and Insular Affairs of the U.S. Senate, 85th Congress, 2d session, S. 3648, of July 9 and 10 of 1958.

This document contains detailed statements of the economic and moral justification of the Navajo Indian irrigation project.

Now, as to industry development—the Navajo Dam will provide water storage over and above the requirement for the Navajo Indian irrigation project, sufficient for large-scale industrial development on our reservation. We have already entered into a coal lease with the Utah Construction Co., and the El Paso Natural Gas Co., which will result in the construction of a thermoelectric plant producing 1 million kilowatts, a plant to manufacture gas from coal, and in the future, petrochemical plants. When the million kilowatts of power

are available at reasonable rates, we have reason to believe many more industries will be attracted on to our reservation. These industries will concentrate in the coal region of district 13 between Farmington and Shiprock, N. Mex. This is in the immediate vicinity of the proposed irrigation project, and the industries can be served with water from the main canal of the irrigation project for a very reasonable additional cost.

The industrial development I have just outlined will be done predominately by private enterprise which will pay taxes and water-delivery charges and will be ready and able to repay the Government many times for the investment in water diversion and delivery works.

However, the Navajo Tribe is also investing its own funds in industrial development. We have appropriated $7,500,000 for the construction of a new sawmill at Red Lake, N. Mex., which is some 10 miles up the Black Creek Valley from the capital at Window Rock. The new plant will provide employment for over 300 Navajo Indians, and sustenance for their families. We also contemplate national industries utilizing Navajo forest products in the future, such as hardboard plants, which will provide additional employment.

We have under consideration a proposal of the Santa Fe Railroad Co. to build a spur track to Red Lake. If sufficient water is made available in the Red Lake area it is entirely possible that another industrial center will come into being. We believe that 15,000 to 30,000 acre-feet of water should be brought from Navajo Dam to the Red Lake area. Sufficient water will be available for this purpose at the Navajo Dam.

I believe providing industrial and irrigation water for the purposes I have just outlined is the only large-scale Federal water development program we Navajos need. For the most part the Navajo Tribe is now doing its own stock water development work and domestic water development. We are currently paying all operation and maintenance charges on the existing projects on our reservation and for our wells; and I believe we can continue to do so indefinitely.

In fact, the major water developments I have mentioned above together with education and roadbuilding are probably the only Federal programs the Navajo Tribe could not do without if the Navajo people are to advance to the same standard of living as the rest of the people of the United States.

Please do not misinterpret what I say.

There are other wise and beneficial Federal programs going on in the Navajo country that we wish continued, but if we had to we could probably somehow survive without them. But without water development on a large scale our children and grandchildren cannot continue to live in the Navajo country. Water development is literally a life-and-death matter to us.

This committee has specifically asked comments on the extent to which water resource activities are related to the national interest. Congress has acknowledged time and again: in the Treaty of 1868, in the Navajo-Hopi Rehabilitation Act of 1950; and in the Colorado Storage Act of 1956 to give three examples—that providing the Navajo people with the equal economic opportunities to the other Americans is a matter of national concern.

Thus, it is a closed question that eliminating poverty is in the national interest. The choice before Congress is not between spending

nothing and spending something on the Navajo Indians. It is between continuing expenditures for emergency relief and palliative measures and wise and large-scale investments that will once and for all put the Navajo people on their own feet. Of all such investments, the Navajo Indian irrigation project, including the water delivery capacity necessary for industrial development in district 13 and in the Red Lake area, is perhaps the wisest and in the long run, probably the least expensive for the Federal Government.

At the present time there seems to be a concerted and well-financed attack upon Federal resources development. I know I do not have to persuade this committee of the shortsighted folly of those people who would leave the western third of the country in its semidesert condition in order to reduce the Federal budget. Not only Navajo population but all the population in the West is increasing rapidly. Without continuing irrigation and industrial water development, the West cannot support this population at its present standard of living let alone solving the problems of subtandard economics like that of the Navajo Tribe. It is unthinkable to me that Congress would let one-third of the area of this country remain undeveloped for the shortsighted and misguided purpose of "fighting inflation." This is a life-and-death matter to all Western people, Indians and non-Indians alike. If water development by the Federal Government does not go forward steadily and at an increasing tempo, there will be nothing for the children to do but emigrate to the slums of the East. I might mention here that 57 percent of our Navajo population is under 20 years of age.

The result of suspending or curtailing the Western development would be a national disaster. Indeed, continuing large-scale Federal water development will spell the difference between preserving our country as a democracy or ultimately reducing it to the conditions of those countries of the Old World where youth has no opportunity and, consequently, turns to radicalism and dictatorship.

Thank you very much, Senator Anderson and the committee.

Senator ANDERSON. Thank you, Mr. Gorman, and through you, Mr. Jones and the Navajo Tribal Council, for a very fine statement. Particularly, I like your reference to the fact that the West has to be developed if these children are going to be attracted to it. You are putting a number of Navajo children in schools in Phoenix, Los Angeles, and Utah, and various places from New Mexico. You want those children to come back home to a good reservation, don't you?

Mr. GORMAN. Yes, sir.

Senator ANDERSON. You had a road bill that went through to give $20 million for highways 1 and 3. Do you think that would help to open up the area to industrial development to some degree?

Mr. GORMAN. Yes, sir, Senator, very definitely.

We think the reservation will be open to industries. We have already laid plans and face that direction.

Senator ANDERSON. You mentioned the Red Lake area, with which I am familiar, and I saw the chairman of the council who was out in California last week trying to negotiate some business transactions with California firms for the use of this timber. You mentioned the use of maybe 15,000 acre-feet of that lake. That would come from New Mexico's allocation of the Colorado River project because it still is inside New Mexico?

Mr. GORMAN. That is right.

Senator ANDERSON. Would you use it right there for industrial purposes, or in that general area, or would you make it available to a rather large area around Red Lake so that whatever type of industry might come in there could be accommodated.

Mr. GORMAN. That is right.

We aim to make that water available to the industrial development, first, and then what is left over we will let the Navajos use.

Senator ANDERSON. Is the new sawmill on the New Mexico side of the line?

Mr. GORMAN. New Mexico side of the line; yes, sir.

Senator ANDERSON. It is not very far, is it?

Mr. GORMAN. Not very far.

Senator ANDERSON. The agency at Window Rock, Senator Kerr, is beautifully located in Arizona.

The CHAIRMAN. I have been there.

Senator ANDERSON. You can run only a few feet and you land in New Mexico. It is a nice location and you have a similar situation in Red Lake that will be fine.

Mr. GORMAN. Thank you. Yes, sir.

Senator ANDERSON. Thank you very much, Mr. Gorman.

Mr. GORMAN. Thank you.

Senator ANDERSON. In order that Senator Kerr does not think that men monopolize everything, we will now hear from Mrs. Leland, please.

STATEMENT OF MRS. STANLEY J. LELAND, STATE CHAIRMAN, NATIONAL WATER RESOURCES STUDY, LEAGUE OF WOMEN VOTERS OF NEW MEXICO

Mrs. LELAND. This is a very brief statement. I will deliver it standing, if I may.

Senator ANDERSON. You may.

Will you state your name.

Mrs. LELAND. I represent the League of Women Voters.

Mr. Chairman and members of the committee, I am Mrs. Stanley J. Leland of Santa Fe, the New Mexico State chairman for the nationwide Water Resources Study by the League of Women Voters. Let me thank you for this opportunity to appear here today, on behalf of, not only the members of the league in New Mexico, but also on behalf of our 130,000 women members throught the Nation, including those in places where no field hearing is to be held. We have worked long and hard on our study; to have it recognized in this way by so eminent a group as this committee gives a status and a feeling of reality to all our efforts which could scarcely be achieved in any other way.

I shall try not to duplicate what you have already heard from the representatives of the League of Women Voters in other States—who have kindly sent us copies of their statements—or what you are hearing from other agencies in New Mexico, except to repeat that we of the league in New Mexico are in favor of some such measure as Senator Murray's bill, S. 2549, on the basis that it might be a step in the direction of coordinated planning. When Senator Murray introduced his bill, you will recall, he invited discussion and amendments;

we have no doubt some improvements in the bill. But we are in favor of some such measure for continuing review of national water resources and, above all, of coordination in planning.

The Murray bill has been discussed in the local leagues throughout New Mexico. Their reports in favor of it were unanimous. You may be interested in a few of their added comments.

The Los Alamos League remarked:

> Of course, here in the West, where the Government is deeply involved in water development projects, coordination is very important.

And league members in Gallup hope—

> that the coordinating agency within the executive branch of the Federal Government might be under an agency head rather than too directly under the President, as people with longer background seem to have greater understanding of the needs in this field.

Members in Silver City offer a direct word for you:

> We urge the Senate Select Committee on National Water Resources Board to coordinate the work of the various Cabinet offices involved, with Commissioners from each State.

Members of the local leagues throughout the State have also held discussion sessions on a certain "Summary Statement of Emerging Consensus"—copy furnished—having to do with nationwide policies which the league may advocate, which was drawn up on the basis of our first 3 years of work on water resources at our national council last spring. Members in New Mexico are in substantial agreement with each of the 9 points, except that some feel unqualified to solve matters of financing.

With regard to the special problems of our own State, the League of Women Voters of New Mexico wishes to make only three points here today. Our studies have covered many aspects of water problems in various parts of the State: the Sandia Conservancy District in Albuquerque; the Navaho Dam and its effect on northwestern counties; the San Juan-Chama River diversion project which would benefit Santa Fe and all of the Rio Grande basin—but these are individual cases. On any and all such cases, we say only that we believe they should be decided on the basis of a wise policy, a coherent, consistent policy, a predictable policy, which includes consideration of the many factors which are the concern of the four standing committees of the Senate, members of which make up this select committee.

We are mindful of the select committee's September 3 statement outlining "information desired at field hearings" with questions regarding amounts of water to be required with future population growth and increasing economic activity. Without any undue modesty, these estimates are, we feel, better left to the experts in these matters, such as our good friend Steve Reynolds, our State engineer.

As no more than ordinary citizens, who have tried to make ourselves well-informed on this matter of water resources, particularly in our own region, we would offer, not final answers, but lines of inquiry which, on the basis of our study of our own part of the Nation, we believe the select committee might profitably pursue in its search for a basic pattern for the ultimate water resources policy for our country as a whole.

Of these lines of inquiry, we offer three as of critical importance in New Mexico. Each holds the answer to one of our big problems.

Each answer will call for that coordination of planning which we hope someday to see.

The three points are: pollution control, interstate stream compacts, and silting.

Pollution control is already being mightily assisted by the work under Public Law 660. Projects to enlarge and modernize sewage-disposal plants in cities and towns of New Mexico are being carried forward. The State health department is being heard here today on this matter. But here, in addition to problems which are nationwide, we have a special aspect to this problem, like so many situations in New Mexico. It is a pecular one. I refer, of course, to the Animas River, that obscure little stream, scarcely more than a creek, really, which has leaped into national prominence because it presented a problem in interstate stream pollution—with radioactive wastes. As you doubtless know, the Atomic Energy Commission and the U.S. Public Health Service, as well as the State health departments of the States concerned, are already at work on the problem. Senator Clinton P. Anderson, in his newsletter of October 13, has given a concise résumé of what is being done about this threat to the well-being of a portion of the State.

Our proposal is that the select committee consider the Animas River not as an isolated problem which can be solved and then forgotten but instead that you gentlemen regard it as a takeoff point and include in your roster of matters on which we need a Federal policy the control of radioactive wastes in any and all waters.

INTERSTATE COMPACTS

With your many recent travels around the West, you must have heard this very often. Well, here again New Mexico has a special problem—our streams, so many of them, originate in Colorado and wind up in Texas or Arizona—with us in the middle.

The compacts, of course, provide means for amendments, but the initiative must come from the States if any compact is to be changed. It appears that the States tend more toward hauling their neighbors to court for nondelivery of nonexistent water than toward amending what is proving to be an unworkable agreement.

So, on proposal No. 2, might there be some way in which the Federal Government could encourage and facilitate sensible changes in interstate compacts?

SILTING

Our first two points consider water as a consumer commodity that we want more of. Now let us regard water as an instrument capable of violent and vast destruction, not only in a dramatic day of crisis, but bit by bit, over the years.

In the silting problem, it seems evident that the remedy lies not in building bigger dams but in treating the trouble at its source, to keep all that earth and sand where it will do good instead of harm, to keep it on the fields and rangeland where it belongs. We have ample evidence on every hand of the disasters wrought to the land when overgrazing or neglect allows those fragile polka dots of turf to be washed away by our occasional driving rains which then go rampaging down the arroyos at ever-accelerating fury, carrying ever-increasing tons of silt to fill up the eventual reservoir.

Federal lands in New Mexico appear to be well tended. In particular, we have had occasion to admire the work being done by the Bureau of Land Management in its Rio Puerco project which we inspected thoroughly on a field trip. We have soil conservation districts, conservancy districts and other groups, each with a little core of dedicated souls who do their utmost to bring the word to their neighbors, now and then with some success. Here and there, they succeed in convincing people that it is worth their while to preserve their turf, to prevent widening gulleys, in order to allow the rain to sink into the ground. But not in enough places is this true.

One feature of New Mexico with which Senator Anderson is familiar but which may perhaps be news to Senator Kerr, which makes a difficult problem, is the chopped ownership of the land. It is so chopped up that the last time anyone had the courage to try to map it was in 1941.

Here is the 1941 map of which few copies now remain. I am giving you my only copy. I hope it may prove an investment on behalf of New Mexico.

(Map unable to be reproduced.)

These portions which appear gray from a little distance are, in fact, white with here and there little blue and red dots. The white is public domain, the red is private land, the blue is State land.

The enabling act through which New Mexico became a State, provided that these little blue dots of the public domain land should be set aside, to be administered by the State land commission, for the benefit of schools, colleges, and institutions for care of unfortunates. That pact, furthermore, specified that the State land commission must turn over all the income from these bits of land—save for salaries of administration—to those institutions; there was no provision for using any of the income to take care of the rangeland.

Our State commissioners are honest, diligent men. The present commissioner, Mr. Murray Morgan, has repeatedly stated that he would like to take better care of the State lands if arrangements could be made to change this outdated provision of the law. It is also true, at the same time, that the State land commission no longer receives its major income from grazing rights; mineral rights now account for such a great preponderance of this income that there is less incentive than in former days to worry about what the grass looks like. To make the desired change in the law would require an act of the U.S. Congress.

I have written to New Mexico's Senators and Congressmen about the matter of money to care for the range on State lands, and they confirm that it will take an act of the Congress of the United States to make the necessary change. Thus far nothing has been done, so far as I know. But if the Federal Government is going to participate in the planning and financing of dams, it surely behooves the Federal Government to look to the conditions which cause the dams to become less useful with each passing year because of the silting up of the reservoirs.

Proposal No. 3 then is that the Federal Government put more pressure on the States to take proper care of land surface, and endeavor to help where it can.

Again our thanks, gentleman, for your courtesy. We shall look forward to learning the results of your studies.

Senator ANDERSON. Mrs. Leland, let me compliment you on the brevity of that statement and the well-organized and fine presentation you made.

Mrs. LELAND. Thank you, sir.

Senator ANDERSON. I only want to say with reference to this proposal on the section that the revenue from those sections is 16, sometimes 32, sometimes 36, has been dedicated to the public schools of this State, and the man who tries to take it way from the schools to give it to Mr. Murray Morgan, who already has a lot of money, would be a brave man to begin with and probably one who would be retired to private life by a large and enthusiastic majority.

Mrs. LELAND. In short order.

The CHAIRMAN. He would be giving his political life to a last noble but unsuccessful effort.

Senator ANDERSON. What I am trying to say is that there are other ways by which the land office might administer this without dipping into the revenue of the schools. The passage of the sales tax was extremely difficult.

The land pattern has changed somewhat since this 1941 map. You take out of this whole area where you have a lot of blue and red dots the MacGregor Ranch and the White Sands Proving Grounds and all the rest, so that a whole section has disappeared.

Then Howard Gorman will tell you that the Navajos are very hopeful of arranging some trades of land in northeastern New Mexico so that their reclamation project may be moved into a contiguous area that formerly was allocated to the south San Juan project, and would remove from that very expensive project the long fingers of land that reached up into small valleys along the rivers and creeks and now will give them a compact area of some 100,000 acre-feet so that gradually we make progress. It is slow sometimes and it is difficult, and we are glad we have the support of the League of Women Voters and people like you.

Mrs. LELAND. Which you do indeed. Thank you.

The CHAIRMAN. Senator, I want to congratulate you upon the wonderful presentation being given here by your New Mexico people, and say to you that I deeply regret commitments in Oklahoma make it now necessary for me to leave but to urge you to put the full hearings available into the record and that it will be of greatest benefit not only to the committee but to me.

Senator ANDERSON. I just wonder if this group would not like to give this great Senator a hand. [Applause.]

The CHAIRMAN. I will say this, as long as you continue to keep Anderson in the Senate, Kerr will be more effective not only in Oklahoma but anywhere else, and that ought to get a hand, I think. [Applause.]

Senator ANDERSON (presiding). I wonder if Mr. Schad and Dr. Ackerman would come up here and help me as we go along.

Dennis Harris, vice president, New Mexico Farm & Livestock Bureau, and chairman of its land and water use committee.

STATEMENT OF DENNIS HARRIS, VICE PRESIDENT, NEW MEXICO FARM AND LIVESTOCK BUREAU, AND CHAIRMAN OF THE LAND AND WATER USE COMMITTEE

Mr. HARRIS. Senator Anderson and staff, my name is Dennis Harris and I am vice president of the New Mexico Farm & Livestock Bureau and chairman of its land and water use committee.

The New Mexico Farm & Livestock Bureau is a voluntary organization of New Mexico farmers and ranchers with a membership of over 9,300 farm families. For many years the organization has been keenly interested in the water problems of the State of New Mexico. It offers this statement to reflect, primarily, the agricultural point of view.

The State of New Mexico is a semiarid region in which farming is completely dependent upon irrigation. The available supply of surface and ground water is quite limited. With the exception of the San Juan River Basin in northwestern New Mexico, practically all surface water supplies have been fully appropriated and put to beneficial use. All known bodies of ground water occurring in substantial volume in areas capable of agricultural development are in use. Heavy demands have been imposed upon the limited water supply in New Mexico by agricultural and nonagricultural requirements. The latter include domestic, industrial, and recreational uses of water. The situation created by a limited water supply is further complicated by the occasional occurrence of severed droughts that deplete surface flow and reduce recharge to ground-water basins. The extreme fluctuations in precipitation and in volume of streamflow that occur in New Mexico from year to year present a factor that must be kept clearly kept in mind in dealing with water problems in the State.

The importation of surface water supplies into New Mexico from out-of-State sources, with the exception of the proposed San Juan-Chama project, appears to be impractical because of the lack of surplus water in nearby areas and because of the heavy cost involved. The San Juan-Chama project will be, in effect, a diversion from one New Mexico river basin into another, although the diversion works will be located in Colorado.

Population growth in New Mexico since the end of World War II has been exceptionally large, on a percentage basis, and the increase has occurred mostly in urban areas. A substantial portion of the influx of population into New Mexico in recent years has resulted from the establishment of important Federal defense installations in the State. Rapid population growth promises to continue. Population growth has led to increased nonagricultural water requirements which must be obtained from the limited supply of ground and surface water available in the State.

The State of New Mexico is confronted with the fundamental problem of making the most efficient use of the available, and strictly limited, supply of ground and surface water in order to sustain its economy and to provide for anticipated increases in water requirements.

The State must discourage the development of uses that will encounter future difficulty by exceeding the safe, normal supply of water available; or that will be confronted with economic disaster when

water supplies temporarily fail because of prolonged droughts that occasionally occur in the State. The "mining" of ground water supplies, or use far in excess of the rate of recharge, is an occasional source of difficulty. The overappropriation of surface water can cause serious and prolonged difficulties.

An appraisal should be made of the New Mexico water problem and the problem should be stated in specific, rather than in general, terms. The following procedure is suggested:

A current inventory should be made of usable surface- and ground-water resources in New Mexico. At the same time, a list of present uses for agricultural and nonagricultural purposes should be prepared. Using present requirements as a base, and employing reasonable estimates of future increases in agricultural and nonagricultural uses, the future water requirements for New Mexico should be estimated. Work has previously been done on the compilation of an inventory of water resources that can be used as a starting point. Once compiled, these data should be kept current.

This information will provide the basis for a more accurate appraisal of the water problem that faces New Mexico.

The next step is to attempt to solve the problem, over a period of time, by using the State's water resources in the most efficient manner possible to serve its agricultural and nonagricultural requirements. In providing for increasing nonagricultural water needs, the interests of agriculture should be clearly borne in mind.

Agriculture in New Mexico is, and will always be, an important factor in the economy of the State. Agricultural income is a substantial and reliable portion of the State's total income. It is not transient in character. In meeting the problem of providing for nonagricultural water requirements, agriculture should not be disturbed. Since nonagricultural water uses can, and do, pay considerably more for water than is possible in the case of agriculture, every attempt should be made to satisfy nonagricultural water requirements from higher cost sources that will not encroach upon the water supply to support the highly productive agricultural areas of the State.

If it should become absolutely necessary to divert agricultural water to nonagricultural uses in the future, such water should be transferred only from the least productive, or marginal, agricultural lands.

In attempting to apply the State's water resources in the most efficient manner possible, the application of feasible conservation measures for the purpose of reducing, or eliminating, the waste and the loss of ground and surface water is imperative. In developing a program of this type, the following procedure is suggested:

1. Present agricultural and nonagricultural wastes and losses of water should be identified and analyzed in order to determine the scope of the problem of conservation.

2. Feasible methods of reducing, or eliminating, existing wastes and losses must be determined, and a continuous effort must be made to apply these methods.

There are a number of ways in which the Federal Government can assist in the development and proper use of the water resources of the State of New Mexico, in addition to the construction of sound and essential reclamation and flood-control projects. They are enumerated below:

1. Stream-gaging activities of the U.S. Geological Survey should be continued without interruption and should be expanded in cases where additional data are clearly needed. Accurate and consistent stream measurement is essential, not only to determine the volume of water available, but also for the proper administration of the State's surface-water resources, including the division thereof among the various areas dependent upon surface water.

2. The ground-water investigations of the U.S. Geological Survey should be continued on a consistent basis in cooperation with State and local agencies. Ground water is an important element in the water resources of the State of New Mexico. Exploration for new sources of ground water should be carried on. Information regarding the location, extent, rates of depletion and recharge, quality and accessibility of existing ground-water supplies; as well as the relationship between surface and ground water, is absolutely essential to the proper development and administration of the water resources of the State.

3. Current Federal investigations concerning the desalinization of water are of potentially great importance to the State of New Mexico. In an area of limited water resources, such as New Mexico, the ability to reclaim presently unusable water on an economical basis means, in effect, an additional source of water. It will be of particular significance in connection with the problems of augmenting water supplies for nonagricultural uses at such time as the cost of reclaiming water may be brought down to a level within the ability of such areas to pay.

4. Despite the somewhat meager results achieved to date, investigation of the possibility of increasing the production of moisture by artificial methods should be continued. The development of feasible methods of increasing moisture yields in semiarid regions will be of great value to those areas.

5. Current experiments in the reduction of reservoir evaporation losses should be continued in order to attempt to discover feasible methods of reducing those very substantial losses.

6. Improvement in present methods of vegetation control and eradication, and the development of new methods, should be given adequate attention because a very substantial loss of water is sustained by reason of consumption by natural vegetation.

7. Work should be continued on the problems of determining the most satisfactory quantity of water to be applied to crops and the proper time and manner of application of irrigations. The application of water considerably in excess of plant requirements occurs in irrigated areas and is responsible for unnecessary use of water.

The Western States, including New Mexico, have rapidly developed during the past 20 years. People from other parts of the country have found that the West is a pleasant place in which to live. Climate and natural resources have encouraged rapid economic development in the West. World War II and the subsequent international situation, have caused the Western States to become the sites of important defense industries and installations. The Western States have become an important part of the United States, and their economic progress and welfare have more than a passing effect upon the national economic situation. The economic progress and welfare

of the various States determine, collectively, the progress and welfare of the Nation.

Water is one of the principal factors, and sometimes the key factor, in the development of the Western States. They have long been aware of the vital importance of water. They have developed substantial bodies of water law. By their own efforts and with the assistance of the Federal Government, they have made considerable progress in solving the physical problems involved in making the most effective use of their water supplies.

Since the West is becoming an increasingly important area in the Nation and since water is one of its primary problems, the proper solution of its water problems is a matter of national importance and is directly related to the national welfare. Water is a basic necessity, without which economic development and progress are impossible. Its proper development and economical use are obviously in the national interest.

The proper control of water to prevent flood damage to the highly developed river valleys in the United States has long been a matter of national concern. The Federal Government, through the Corps of Engineers, Bureau of Reclamation, Geological Survey, the Department of Agriculture, has participated for many years in the development and physical regulation of water resources in the United States. It should continue to do so because the problem is often, from the geographical and financial standpoint, beyond the ability of the individual States to solve. The assistance that the Federal Government renders to the Western States in working out sound solutions to their water problems yields national dividends.

It should be emphasized, however, that Federal financial contributions to water development should be used for sound and essential purposes. Indiscriminate and reckless expenditures on unsound and unnecessary projects not only fail to yield national dividends, but will discredit the program of participation in the development of water resources. Federal participation in the development of the water resources of the States should not result in any degree of Federal domination over water supplies, or in the subordination of State water laws to Federal interests.

The basic principle that water belongs to the people of each State, and that the water laws of the States exclusively govern its appropriation and use, should be kept clearly in mind. In this connection, the New Mexico Farm and Livestock Bureau supports the enactment of S. 1416, 86th Congress, a bill to recognize the authority of the State relating to the control, appropriation, use, or distribution of water within their boundaries, and for other purposes, as a means of preventing Federal encroachment upon the principles that ownership and control of the water resources of a State rest exclusively with the people of the State; and that the provisions of State law relating to water shall be supreme as to the control, appropriation, and use of the State's water supply.

On behalf of the New Mexico Farm and Livestock Bureau, I would like to thank you for the opportunity of appearing before this committee.

Senator ANDERSON. I am glad you came. It was a fine statement from the Farm and Livestock Bureau, and I am happy to have it.

Mr. Cater.

STATEMENT OF W. P. CATER, FARMER AND RANCHER, CERRO, TAOS COUNTY, N. MEX.

Mr. CATER. Senator Anderson, I will be very brief in this statement.

I very much appreciate the opportunity of appearing before you and presenting my statement.

I am W. P. Cater, a farmer and rancher at Cerro, Taos County, N. Mex., where I have lived for about 35 years. I wish to express my appreciation of the fact that you are holding these hearings to help plan for the water needs for the future.

We in New Mexico are very much aware of the need for such planning, as we know that our future needs will make necessary careful and efficient use of the water available. We have water problems in Taos County in planning to take care of our normal growth. But we feel that they will be taken care of if the San Juan-Chama transmountain diversion is constructed.

I would like to urge that serious consideration be given to this very important project so that it may be approved and funds appropriated for it as soon as possible. I believe that this project will do much to relieve the water situation in the middle and northern Rio Grande Valley.

It is my belief that when we consider the development of our water resources, we should try for a full and complete development. We know that our water resources are limited and we should get all that we can out of them. When hydroelectric power can be developed along with the construction for irrigation and other needs, then it should not, in my opinion, be overlooked. And I would suggest that in the overall development of the Rio Grande, the damsite at Chiflo should not be overlooked, for it is the last feasible site in New Mexico.

This site has been surveyed and studied. It has been determined that a large amount of power can be developed without interfering with the orderly use of the water for other purposes, and it will also provide very important flood control benefits. It has been determined that the income from the power developed will repay the cost of the dam in a reasonable time.

I would like to urge also that the Congress give serious consideration to legislation that will recognize the jurisdiction of the States over the waters within their boundaries. I feel that some clarification of this important subject is needed to protect existing water rights, and that this is a proper function of the Government of the individual States.

I thank you, Mr. Chairman, for this opportunity.

Senator ANDERSON. Thank you, Mr. Cater.

I want to say you heard me raise some questions about Chiflo, and I am very hopeful the thing which you ask for may be a possibility.

I am also very pleased at your comment about the San Juan transmountain diversion. The bill has twice passed the Senate. It is in the House. We are very hopeful that something will come out along that line.

Finally, on this conflict between the States and the Federal Government, we did, in the Interior Committee, at my request, a résumé of all these recent court decisions that have worried some people to see if they were tending to break down the established pattern of

State regulation. Sometime, if you would like a copy of that study, which is long and very legal, I will be glad to provide it for you.

Mr. CATER. I appreciate it, sir.

Senator ANDERSON. Thank you for being here, Mr. Cater.

Mr. CATER. Thank you very much, sir.

Senator ANDERSON. Fred Thompson, good morning.

STATEMENT OF FRED A. THOMPSON, DIRECTOR, NEW MEXICO DEPARTMENT OF GAME AND FISH, AND SECRETARY TO THE STATE GAME COMMISSION

Mr. THOMPSON. Senator Anderson, my name is Fred A. Thompson, director of the New Mexico Department of Game and Fish and secretary to the State game commission.

The State game commission is charged with the responsibility of the protection of game and fish of the State of New Mexico for their use and development for public recreation and food supply.

It is needless to say that the water resources of the great Southwest are exceedingly limited and, by virtue of this fact, it is necessary that every drop of water in this region be conserved to the utmost and its use be for multiple purposes.

The fisheries of the State of New Mexico may be small, comparatively speaking, and under the present form of operation are destined to remain in limited status for years to come; however, with reconsideration of the water uses, the fisheries and recreation of the State could be improved tremendously.

It is readily recognized that perhaps the basic uses of the water might be considered as irrigation, domestic and industrial; however, along with these items, we of this Nation are rapidly realizing that proper and adequate recreation is part of our everyday living and just as essential as the food we eat; therefore, any management of conservation or manipulation of the water resources should also include adequate protection of this resource for the purpose of recreation—not only from the point of view of fishing but from boating, swimming, and other forms of recreation attracted by water.

In other reports, you will perhaps find the trend of population increasing in the State of New Mexico; however, from the bureau of research of the University of New Mexico, we find the following figures of population for the State, both actual and projected into the future:

1930	423,317	1960	989,800	1980	2,256,700
1940	531,818	1965	1,257,200		
1950	681,187	1970	1,583,000		

We find a similar correlation of fishing pressure based upon fishing-licenses sales as listed below and projected into the future:

1930	20,598	1950	101,022	1970	180,000
1935	17,145	1955	95,389	1975	190,000
1940	33,901	1960	145,000	1980	210,000
1945	47,755	1965	175,000		

It must be borne in mind that these figures represent the economy of the fisheries and do not include other forms of recreation derived from our water resources. The increase in population is reflected

proportionately in the increased demands for more fishing and other water recreation.

The economic value of fishing alone in the State of Mexico this past year amounted to $27 million. This figure represents the money received by fishing resort owners, boat sales, fishing-tackle sales, automobile expenses, and other items connected with the recreation of fishing. In short, it represents one of the larger industries of the State.

In consideration of long-time amortization, it might be considered that a surface acre of water under varying conditions may be valued at between $1 and $5,000. The beautiful part of water for recreation is that, in general, it is nonconsumptive and can still be used for many of the other purposes.

In a report submitted here by the New Mexico State engineer for the State of New Mexico you will find more detailed figures on requirements of water for recreation and you will find further more information relative to this subject in a report to the National Outdoor Recreation Resources Review Commission.

It is proposed that between 10 and 25 percent of the water being developed in the State of New Mexico be considered for the purpose of recreation. This includes the development in respect to flood-control dams and irrigation requirements. This is to imply that the tax dollar can be used for the economy derived from recreation as well as that derived from agriculture or other related economy.

Finally, from the viewpoint of those interested in water conservation of fisheries and recreation, we cannot encourage too strongly the need for high-watershed protection and water storage. This operation would not only furnish better and more permanent water supplies downstream but it would also supply a tremendous amount of fishing and recreation much needed by this State.

Thank you.

Senator ANDERSON. Thank you, Mr. Thompson.

I could not help but be attracted to your figure on page 3 that the economic value of fishing alone in New Mexico this past year was $27 million. It is of very significant importance to me.

Mr. THOMPSON. Yes, sir. That paralleled very favorably with the national picture, too, Mr. Chairman.

Senator ANDERSON. It shows the value of this water.

Senator ANDERSON. Is Dr. William Koster here?

Dr. Gerald Meyer?

W. A. Williams of the State conservation service?

I would not want to leave the impression by reading these names that these people are being discourteous by not showing up.

The offices of Senator Chavez and my office felt that those organizations, institutions, and individuals who had long been interested in this subject should be invited to attend and they were invited. Some of them indicated they would not attend. Others were not certain. When I read a name it sometimes is the name where we were not sure of the situation. Therefore, I would not want it to appear that these people were in any way discourteous.

We were merely trying to afford them an opportunity to come if they wished to do so.

Mr. John O'Connor.

STATEMENT OF JOHN O'CONNOR, CHAIRMAN, WATER RESOURCES COMMITTEE, GALLUP, N. MEX.

Mr. O'CONNOR. Senator Anderson, my name is John O'Connor. I am chairman of the Water Resources Committee of the Town of Gallup, northwestern New Mexico.

On behalf of the citizens of the town of Gallup, the county of McKinley, and the residents of the vast area of northwestern New Mexico that it is our privilege to serve, I wish to say that we are most happy to accept the opportunity afforded to us to appear before this important committee of the U.S. Senate. We appreciate this opportunity because all our hopes and fears for the future development of this important area are dictated by the availability of adequate water supply.

We in Gallup, N. Mex., are faced with a multifold problem. We have a pressing need for municipal and domestic water to supply the needs of our citizens who at the present time are, due to cost and availability, reduced to using approximately 60 gallons per capita per day, a figure that represents about one-third of the national average.

Our second need is for adequate water supplies for our Indian neighbors who are growing in population at an accelerated rate. Their need is for economic and industrial development.

Our third need is a need related to the national defense. This area of northwestern New Mexico has in the bowels of its earth the resources of oil, gas, uranium, and other minerals that are vital to our national defense program. The ultimate development and use of these resources will depend to a great extent on the availability of adequate water resources.

Daniel Webster once said:

> What do we want with this vast worthless area * * * this region of savages and wild beasts, of shifting sands and whirlwinds of dust, of cactus and prairie dogs? To what use could we ever hope to put these great deserts and those endless mountain ranges?

The answer to Mr. Webster's remarks are self-evident today in relation to the vast mineral resources available to us. Yet the one thing that can bring fruition to this vast area and give it the opportunity of fulfilling its destiny is the development of its water resources.

The ill-conceived development and conservation of this great resource is an extravagance that we as a nation cannot afford. Even though our water resources is a renewable resource we must remember that it has a dollar value and that every single gallon that is permitted to flow to the sea is an irretrievable waste.

We need new research tools but before that we must be determined to make better use of those already in existence if we are to meet the great challenge that the future holds before us.

We must accept this challenge of achieving the maximum beneficial use of all our available water resources. It is generally accepted by the foremost authorities in the field of water development that the highest beneficial use is that of direct use by man for his immediate benefit, therefore the first call on the resource will be that of domestic and municipal use.

The second claim will be for economic development in the fields of agriculture and industry. As all these uses are considered in future

planning we must always keep in mind that as the economic levels rise there will be a continuing increase on the demands for domestic and municipal use and these uses must be included in any future programs which, of necessity, must be constantly flexible.

Regardless of what combination of uses are applied to any given area, the prime consideration will have to be in the area of adequate storage facilities.

We must at all times, in planning for the future, be guided by the premise that what is necessary is the maximum use of the resource for the benefit of the maximum number of people. In view of this it is essential that a dedicated local leadership in each locality be developed that will motivate the people to first do those things for themselves that are possible and then to organize and present to higher echelons of government those problems which are beyond their ability to solve for either technical or financial reasons.

It is self-evident that man's requirements for domestic water will be satisfied first and up to that point where the total consumption of all water for all uses as dictated by availability will set limits upon the expansion of any given community.

It is upon us, here in the West, that point where our maximum produtcion is lagging behind our consumptive requirements.

Here in Gallup and McKinley County, we have had since the last census in 1950 an estimated population increase of over 60 percent which is 20 percent above the increase for the entire State of New Mexico for the same period and, I believe, above twice the national average.

According to statistics presented in October of this year, by the Bureau of Business Research of the University of New Mexico, the population of McKinley County has increased from 27,451 in 1950 to 44,000 in 1959. This only tells half the story. Our neighboring Indian population, including the Zuni and Navajo Indians, has increased at a greater rate. The Navajos have nearly doubled since 1940 now having a population of between 85,000 and 90,000 persons. A large portion of these people actually live on the reservation within the State of Arizona, but by their proximity to Gallup as the largest community in the area have a tremendous effect on the present and future development of this community.

Gallup, due to its unique relationship with these Indian people, must by necessity relate its needs to the needs of the Indian people. We are joined together, so to speak, by an economic umbilical cord. The growth of these people demand a concerted program of economic development now. That development will by geographic necessity, have to be provided, to a large degree, in the Gallup area.

The present needs are self-evident but the future needs are beyond comprehension when one considers recent Bureau of Indian Affairs statistics which indicate that in the year 2000, which happens to be the target year of this committee's efforts, the Navajo people will number approximately 300,000.

The per capita income of these people at the present time is approximately $500 per annum as against a national average of approximately $2,500. The difference between their total income and approximately a similar non-Indian group at this time is $8 million a year. Unless there are drastic economic changes during the next 40 years the differential will represent $30 million per year, at that time.

This differential will have to be reduced before this segment of Americans can rise above substandard living conditions to the status of equal citizenship. The only possibility of achieving this is through economic and industrial development and this goal can only be achieved through adequate water development.

If a concerted effort is not made in this area of water development then the present drain on the economy for welfare program will continue to rise. At the present time New Mexico's welfare program in this area alone amounts to $1.25 million and without appreciable economic changes can conceivably reach $60 million by the year 2000. The total possible expenditure for this area through 2000 based on median figures could reach $875 millions.

I mention this in relationship to justifiable expenditures for water development. Certainly, a portion equal to a percentage of this figure is justified in that water development will permit economic development and relieve this cost. I might mention that these figures only represent that portion in New Mexico and do not reflect the programs operated by Arizona, Colorado, Utah, the Federal Government, and the Navajo Tribe itself.

A substantial portion of this water problem will be solved by the completion of the Upper Colorado River projects including Glen Canyon and Navajo Dams. It is imperative that authorization for the Navajo Indian irrigation project and the San Juan-Chama diversion be approved by the Congress of the United States at the earliest possible time. These two projects, although far from solving the total problem of water shortages, will go a long way toward alleviating the problem. We have studied our water problems and have spent a substantial amount of money for professional advice and must conclude that the only substantial supply of water available to us is from the San Juan River, a tributary of the Colorado. We will not dwell on this matter as it is a matter of record and has been submitted to the Senate Committee on Interior Affairs. It will suffice to recommend to this body that the final approval of these projects is a part of the answer to the problems of national water resources. I might refer now to a report we have had made by engineering firms.

It states that the data on underground water resources indicate that a little, if any, increase of the water production of the town's well fields can be expected. In fact, the data seems to indicate that the withdrawal of water from this field at the present time exceeds the expected long-time safe yield. Since there is no doubt that the town's present underground water source is limited and probably cannot take care of the town's expanding needs, we are more than 10 to 15 years at the outside, it seems the town should investigate the possibilities and cost of obtaining water from other underground sources.

The only surface course of water supply available to the town of Gallup is the San Juan River in northern New Mexico. This is approximately 100 miles north and will require a 50-mile pipeline.

Obtaining water from the San Juan through the Navajo project would involve obtaining storage capacity in the Navajo Reservoir on the San Juan River and carrying the water through the Navajo canal system to the storage reservoir located in the vicinity of Newcomb which would be necessary to take care of Gallup's water needs during the period when the irrigation canals were not used.

Also, such storage makes it possible to take care of Gallup's water requirements, and I might emphasize here without increasing the capacity of the Navajo irrigation canal system and those required to meet the needs.

Senator ANDERSON. We have discussed this before.

Mr. O'CONNOR. Yes.

Senator ANDERSON. You are saying to us: With the reservoir that *is now being built and constructed, which has 1,700,000 capacity, if* we would take the canals during the period when they are not being *needed for the irrigation of 110,000 acres of Navajo land and allow* some of that water to flow down to the city of Gallup, we would not *need to increase the capacity of those canals and yet could serve the* needs of the very rapidly growing communities.

Mr. O'CONNOR. That is correct, Senator.

Senator ANDERSON. I think it makes sense and I am glad you brought it out.

Mr. O'CONNOR. I think I am saying, here is an item that we referred to before which is a maximum utilization of water as it flows *to the irrigation canals to provide irrigation which can be reclaimed* again at the bottom of the system and reused for the municipal and *industrial uses.*

The cost of this project and in terms of the town of 12,000 to 15,000 people is rather tremendous. It runs somewhere in the neighborhood of $51½ million. But our present class of water development is running in excess of $150 to $200 per year anyway, through underground drilling and so forth with no assurance that we will have a supply at the completion of the expenditures.

So, over a 50-year period even with interest rates and so on we can see that it is within the realm of feasibility for the community to embark on this program.

We might add here, too, that at the present time in our relationships with the Navajo people discussing a program whereby the Navajo people and the town of Gallup will participate in this project to some degree and provide water through the same pipeline through the numerous communities between and that 50-mile radius thus enhancing their position economically, too.

Probably every part of the country is experiencing an increase in population due to substantial medical progress, increased educational opportunities and most certainly the factor of higher levels of living standards.

In recent years, due to climatic conditions and decentralization of American industry, the demands upon the arid and semiarid lands of the Southwest have increased and there is no evidence that these increases will not continue through the foreseeable future. We have seen the continued decline of subsistence farming and ranching and the ever-increasing development of urban populations which by their very nature increase the strain on water resources because no locality has sufficient water available to it naturally to supply its present size and future growth. Inasmuch as water will always be a limited resource it behooves us to embark on a program designed to utilize every gallon for useful purposes.

In this area we have an obligation to protect our watersheds from future damage. Because of the history of past promiscuous misuse

of the watersheds of the Southwest our greatest problem at this time is one of repair and rehabilitation.

We must assume that an equitable balance is established between industrial and agricultural uses of this resource. We must develop through research the criteria for evaluating the long-range total benefit of joint agricultural, industrial and domestic uses of this precious resource.

It is a rare case indeed where any one segment of the economic whole survives without a balance of the other two. It is axiomatic that agricultural endeavors thrive best where there exists a copartner in the form of industry to share in the costs of the total social services afforded to the community. It would appear that the area which does not consume the water beyond further reclamation and use should have the primary lien on the resource.

The uses available must be a form of adaptation of the species to its environment even including industrial use in that it is superior than more smaller users will probably produce greater good than fewer larger users. To illustrate I might quote from A. L. Hagedoorn's "Animal Breeding" where he says—

> One sheep weighing a hundred pounds has only one head and one set of legs; two sheep, weighing a hundred pounds together, have two heads and two sets of legs so that they can be in two different places to hunt the scanty herbs, and for this reason, in conditions where the sheep of 50 pounds can just live, a hundred pound sheep must necessarily starve.

History tells us a great deal about the relationship of man to his land in the arid and semiarid regions of the world. Basically it tells us that man, in order to live successfully in this arid country, must utilize to the fullest extent the skills of science and technology to fully exploit the resources of the area.

The Southwest is pockmarked with testaments of the misuse of our arid lands. The problems that exist today in the Rio Grande Valley, particularly in the northern reaches, can be attributed to poor reclamation practices in the past.

History has also shown us specifically that the 1880's was the beginning of destruction of our watershed lands and companion agricultural resources. The cause was in poor range management, poor harvesting of forest products, crisscrossing of wagon trails and stripping of the land for dry farming.

The effect of these practices are evident in decreased capacity for grazing, scarred land through gulleys and arroyo erosion, blowing sand and sand dunes and the carrying downstream of top soil to silt up reservoirs.

One of the worst examples of the combination of these causes and effects, and one that we in northwestern New Mexico are most aware of, is the Rio Puerco of the west. History indicates, by the evidence of ruins of small communities and farm houses, that this valley was once a prosperous agricultural area.

The expression, "the plow that broke the plains of the American West" has usually meant the opening of a vast new area to the production of foodstuffs for our Nation but in reality the truth of the matter is that due to the lack of knowledge in regard to land management this same "plow" bared the earth to erosion, an erosion that has scarred the West and these scars have not been healed to this day. It was these same plains, denuded of their once-good grasslands, that

became the manmade dust bowls of the early 1930's and the birthplace of the famous "black blizzards" of that period in our history.

In reviewing the problem from a historic point of view, certain things became self-evident.

We must put at our disposal water not now available and we must improve the quality and make better use of that water that is available through increased-production of present supplies and maximum utilization of these supplies.

What we must seek ultimately is a dynamic relationship between our resources and our people for maximum, efficient sustained production.

Our scientific age has provided us with more and more uses for water but has failed to inspire us to more efficient use of this commodity. Rather we have fallen heir to the fallacy that our water resources are of unlimited supply and are constantly renewable. The research in this area indicates that our water resources are not renewing themselves sufficiently to keep pace with the accelerated use dictated by our modern technology.

We constantly see efforts to demineralize the seas and to induce rainmaking but our efforts to control the losses of our rivers and streams as they flow to the ocean has been woefully inadequate.

The mere diversion of the water is only the beginning of what must be a sound program of conservation and better use of the resource.

We must stop the loss through evaporation from our reservoirs and we must reduce and control the growth of waterhogging flora such as the tamarisk and the salt ceder.

The disheartening aspect of this problem is that with our known shortages as much as half of the water diverted from streams, rivers and reservoirs is lost through seepage, evaporation and the water consuming useless flora. The loss here, in the Western States, from these wasteful areas represent over 35 million acre-feet annually or enough to supply a population of 1½ million people for all uses for the same period of time, 1 year.

In the area of evaporation, one possibility has come to the forefront and that is the use of so-called polar compounds, of which household detergents are an example. These compounds form monomolecular films over water and in effect seal in the water. If it is safe for human consumption, and the cost can be maintained at a low level, it might be possible to distributte these compounds to ranchers, small communities and other reservoir operators, particularly those with limited financial ability.

Also in the area of conservation is the matter of our desert trees and shrubs. Although these plants and trees provided food, clothing, medicines, fuels, and other uses to our earlier inhabitants they are now looked upon with contempt and considered to be of no real value.

It would seem prudent in terms of modern scientific knowledge to embark on a program of reevaluation of these natural materials to determine whether or not it may be economically feasible to develop new uses for these unique plants. The woody types of vegetation have a particular affinity to use as pulpwood possibly in the manufacture of paper. It is also likely that some chemical extractive value may exist in many of these plants and trees.

A new area of conservation of our water resources that has appeared on the scene in recent years is that area of reuse. Western industry has become increasingly aware of the rising cost of water and as a result is making efforts to explore and apply technology to the maximum reuse of water. Modern purification systems available to municipalities and industry provides us with the very real possibility of effluent reclamation. This activity is particularly effective in industrial use where the water is not permanently combined with the product. Inasmuch as the reclaimed effluents can be purified to a degree of greater purity than the original water the permanent combining of the water with the product is only provided as an area for greater educational effort.

The need for reuse and the other conservation practices referred to is dictated by the drastic shortages evident in some areas as indicated by the fact that the city of Colorado Springs recently advertised its willingness to pay as high as $350 per acre-foot of water for industrial and domestic use.

Two other major areas of activity that will only be mentioned here are rainmaking or cloud-seeding and desalinization. The efforts in these areas are well known particularly in view of the current program sponsored to a great degree by Senator Anderson to provide a comprehensive saline water program.

One other consideration occurs to the mind in any discussion of conservation and that is the fact that great areas of our most productive lands are devoted to cities, highways, housing, and other nonproductive use at least in terms of providing food production. It is increasingly evident by the wholesale purchasing of productive agricultural lands for purposes of subdivision.

It would certainly be worthy of serious consideration to investigate and encourage the development of these activities to higher topography and to retain the use of the valleys for productive agricultural use in view of our exploding populations.

The continued overdraft of our ground water resources without proper recharge can have only one result, that some day we will have reduced water availability and the consequence of several social penalties on future generations.

Possibly the final result of these hearings will be that the evidence indicates the need for an overall water resource commission of some kind that will be in a position to coordinate and control the many areas, both governmental and private, that are currently active in water development.

It appears that from the limited research undertaken to prepare this statement that there are a great many organizations concerned with our water problems but that each is inspired by its own interests and that there appears to be no overall coordination of the total effort.

Senator ANDERSON. Thank you very much, Mr. O'Connor, and we are very happy that you came here.

You state on page 10 that Colorado Springs recently advertised a willingness to pay as high as $350 per acre-foot of water for water for domestic and industrial use. That does not mean per year.

Mr. O'CONNOR. Per acre-foot.

Senator ANDERSON. One acre-foot?

Mr. O'CONNOR. One acre-foot. It is something in the neighborhood of over 200,000 gallons.

Senator ANDERSON. Thank you very much for your statement.

I want to make one little statement for the benefit of the group here. We have only a few witnesses. It would be probably easier on you to finish this than to go on and try to have a session this afternoon. I want to see if it is not possible for us to conclude this morning.

Thank you very much.

Mr. O'CONNOR. Thank you, sir.

Mr. ANDERSON. Because he is here I want to introduce Diego Abeita, chairman of the Irrigation Committee of the All-Pueblo Council, and say we are happy that the Indians of the Pueblos are still interested in the water problem.

Mr. ABEITA. Thank you, sir.

Senator ANDERSON. I say to you the greatest rule for handling Indian land that I ever heard was laid down at a meeting of the Middle Rio Grande Conservancy project when we were having it in tentative form in 1924 or 1925. We had a big chamber of commerce meeting and invited the Indians. We made speech after speech about our desire to work with the Indians in the development of their land. We then called upon Diego Abeita for a summing up and Diego said, "I give you a simple rule: Drain the land but not the Indian."

We found out how it could be done most satisfactorily to the Indians.

Joe Clark, superintendent of the State Park Commission was required to leave and he left a statement which we will file now with the committee. We appreciate Mr. Clark's preparation of it.

(The information referred to follows:)

STATEMENT OF JOE M. CLARK, SECRETARY AND SUPERINTENDENT, NEW MEXICO STATE PARK COMMISSION

This seems to be a most appropriate occasion to emphasize that more and more persons are looking to the Southwest as an area for vacations and recreation. According to the State tourist bureau, New Mexico receives more revenue from the travel industry than from all of the row crops produced in this State. Obviously, swimming, fishing, and boating are among the most important factors in most recreation areas, here as elsewhere. Thus it is evident that the retention of adequate minimum pools behind any future dams to be built in New Mexico should be firmly assured from the beginning.

Well over 9,000 boats already are owned by New Mexico residents according to an April 1959 estimate made by a major oil company (Mobil). In addition, several thousand other boats are brought into New Mexico for temporary use here each year by residents of other States. This year, Conchas Dam State Park recorded more than 250,000 attendance days, well over 50 percent by Texans. Meanwhile, Elephant Butte, and Caballo Reservoirs had in excess of 600,000 attendance days, at least 50 percent by nonresidents. Nine other lakes in New Mexico also drew sizable volumes of business from boaters as well as angelers. And there is every indication that this business will continue to increase year after year, with the extent of that gain largely dependent on the amount of water available for boating and fishing.

Along with most other sections of the Nation, New Mexico is also seeing a tremendous increase in camping, particularly by family groups on vacation in the Southwest. The availability of fishing, swimming, and boating, in that order, adds greatly to the attraction of any campsite for visitors.

This is in addition to the value of water for recreation use by residents of our own State. Considering it solely as a factor, bringing outside money into this State, the existence and creation of lakes within New Mexico has become tremendously vital to the economy of this region.

Finally, and certainly of equal importance, the allocation of adequate lands for future recreational development should likewise be considered in the planning of any such projects. There seems little question that suitable acreage for

such purpose will be increasingly scarce in future years. Forethought now can save many thousands of dollars and perhaps many millions for this purpose in future years.

Therefore, the State Park Commission of New Mexico urges recognition and serious consideration of the foregoing facts in connection with the future development of any water resources within this State.

Senator ANDERSON. We have one more witness before we come to the pair who are always with us, Hubert Ball and John Patrick Murphy, the stalwarts of our waterworks projects in this part of the country.

From the New Mexico Wildlife and Conservation Association, Mr. Elliott Barker is here. I want you to be recognized, Mr. Barker. Thank you. I am happy to recognize you. I understand that Don Clauser is to make the presentation.

Mr. BARKER. Did you just want us to file the statement?

Senator ANDERSON. If you desire, it will be received.

Mr. BARKER. I would like to have Mr. Clauser read it if he may.

Senator ANDERSON. Come up, Mr. Clauser, and go ahead.

Mr. Barker, we do appreciate your constant interest in the water problems of this area.

Mr. BARKER. Pardon?

Senator ANDERSON. I say we appreciate your constant interest in the water problems of this area.

Mr. BARKER. Thank you, Senator.

STATEMENT OF DON CLAUSER, PRESIDENT, NEW MEXICO WILDLIFE & CONSERVATION ASSOCIATION

Mr. CLAUSER. Senator Anderson.

I am Don Clauser, president of the New Mexico Wildlife and Conservation Association which, for 45 years, has labored diligently for the conservation of soils, waters, forests, wildlife, and other natural resources. We believe that focusing of sharper attention on our national water resources, and the rehabilitation, protection, and management of our vital watersheds is overdue, and that these hearings by the Senate Select Committee on National Water Resources are most timely.

We greatly appreciate the opportunity of presenting a brief statement here today, and we sincerely hope it may contribute something of value to the committee.

While it is repetitious to say that in New Mexico water is our very life blood, that hard fact cannot be too strongly emphasized here in the semiarid Southwest. It is axiomatic that the scarcer a useful commodity the more valuable it becomes. That is why the value of water, good, clean, usable water, in this State is too great to be measured by the dollar sign alone. Instead, its price tag is in terms of the health, welfare, and happiness of all our people.

Pure water for our rapidly growing urban population is essential for healthful existence. Water for industry and irrigation is necessary for our economic development and welfare. Water for recreational purposes and fish and wildlife habitat is equally essential to provide the outdoor recreation upon which our happiness and mental and physical health depend.

We regret that there are often conflicts between the several interests involved. Yet most, if not all, conflicts could be eliminated by appli-

cation of the multiple use principle and a bit of neighborly give and take.

New Mexico's constitution declares that all waters belong to the State, and that beneficial use shall be the basis for its appropriation. Despite the immeasurable public benefits of water for recreation and for fish and wildlife habitat such uses do not enjoy legal status as beneficial uses. While our State engineer, as a matter of policy, has often so recognized them, every effort to obtain statutory recognition of recreation and fish and wildlife habitat as beneficial uses of water has been blocked by the legislature abetted by certain powerful private interests.

It is unjust discrimination for such essential and popular public uses of water not to be allowed the statutory status of beneficial use along with the use of water for domestic, municipal, irrigation, industrial, and stock-watering purposes.

The 5-day week and shorter daily working hours, coupled with more and better roads and modern transportation facilities enables more and more people to seek healthful outdoor recreation. In fact, frequent temporary escape from the stresses and tensions of modern urban living is becoming increasingly necessary. This is borne out by astounding U.S. Forest Service statistics which show that the 68½ million recreational visits to the national forests in 1958 was a huge 700 percent increase over the number of annual visits at the end of World War II.

The Forest Service estimates the number of visits will double again in the next decade, and reach 600 million by the year 2000. That is a faster rate by far than the increase in population.

Water is essential to make those visits satisfying. It will be found that the areas with the best streams and lakes, natural or manmade, attract the most visitors. Fortunately, water for fishing and other recreation is a use only, not a consumption such as that required for irrigation, municipal and industrial purposes.

Naturally, there is comparatively little that can be done to increase the volume of streamflow. However, through proper watershed protection and management we can stabilize the flow of streams and enhance their efficiency and attractiveness for public use by insuring a stabilized clean, clear quality. Various agencies can also build many small reservoirs in the upper reaches of watersheds where the only water consumption will be a slight evaporation loss. Such a program is handicapped by the great difficulty of obtaining water rights which seems out of all proportion to any possible depletion of streamflow.

Fortunately, much of our most productive watersheds are within national forests. The Forest Service recognizes that water is the most valuable of all national forest products and that watershed protection and management, designed to produce the maximum clear, stabilized streamflow is imperative. While only about 11 percent of the State's area is within national forests, it is a fact that most of our usable water originates there. Some estimates are as high as 70 percent. Chief Forester Richard E. McArdle recently stated to another congressional committee that national forests cover only one-fifth of the West but receive one-third of the precipitation and provide half of the waterflow.

On March 24, 1959, the Secretary of Agriculture submitted to Congress a long-range program for the national forests. That pro-

gram recognizes that water, good, clean, usable water, verily is the most valuable product of the national forests. It provides for intensive watershed protection and management. The New Mexico Wildlife and Conservation Association takes this opportunity to express to Congress its approval of that long-range program. It also endorses the watershed work plans and cost estimates set forth in its short-term, initial 12-year period.

In view of the importance of water to meet the future needs of the State we would go further than that and urge that all, or suitable parts, of a number of large Spanish land grants situated in high, mountain country be acquired by the Forest Service. Subsequent administration and management would be for watershed protection to attain the maximum stabilized yield of clear, usable water, together with such other multiple uses as are found to be compatible therewith. The cost would be justified by the long-range water benefits.

Naturally, ownership by the Forest Service will not increase precipitation, but it can greatly improve the quality and stability of streamflow, which is all important not only to recreational uses but all other uses as well. Private owners cannot be expected to manage these huge tracts of land in the long-range public interest. Instead, they must manage them for maximum gain on a comparatively short-range program. Therein lies the advantage to the public in public ownership. Water for the future is the all-important item, not a pittance in annual property tax as some will claim. Besides, the 25 percent of forest receipts turned over to State and county will compensate for any loss in taxes.

Multiple use is the widely acclaimed principle of administration of the national forests. The public's interests would be greatly enhanced if that same policy were more widely applied in the use of our limited water resources.

It is wasteful to impound water for a single use, such as irrigation or flood control, and ignore an essential feature of the recreational and fisheries aspects. In the public interest, in all impoundment projects, provision should be made for perpetual retention of a recreation, or dead storage pool, of not less than 5 percent of the storage capacity of the reservoir. Ten percent would be better.

Every impoundment in this State should add greatly to the fishing and other recreational resources. Irrigation reservoirs have been built and at the dedication ceremonies great stress placed on the recreational and fishing resources by speakers, including U.S. Senators, who derided the thought that the reservoir might ever be drained and those resources destroyed. Then when the game department had built up the fishing to its optimum condition, the gates have been opened and all those costly resources have literally gone down the drain with the last drop of water.

Such procedure is to ignore the multiple-use principle which operates in the best interests of the public. Yet that has happened many times and it will continue to happen until Congress makes provision for reservation of conservation pools in all impoundments. Talk to the U.S. Reclamation Service or Department of the Interior about proposed impoundments and you will be told that plans and specifications will take into consideration recreation and fish and wildlife habitat. But mention inclusion of specific provisions for a minimum dead storage or conservation pool and they balk and refuse to budge.

Congressman Joseph M. Montoya can attest to such current experience.

Another example may be cited. When the U.S. Army Engineers built the Jemez flood control dam about 18 miles from this city a few years ago, everything possible was done to get them to include in the operation plans provision for a minimum recreation pool, but it was not done. The water would be held back only during the flood period and then all released gradually. In 1958 there was a very good runoff, and it was decided to hold considerable water in storage through the summer. Obviously there were no fish, but the reservoir speedily became popular for boating and other water sports.

In 1 day alone the engineers report 13,000 visitors to the reservoir. That illustrates the short-sighted folly of not providing for permanent recreation pools in all such impoundments where the only consumption of water would be evaporation.

You will be told that an interstate compact would prohibit such a thing. If that is so, then the public's interests have been sold down the river to Texas and a way should be found to renegotiate the compact.

Another instance where the public is being made the goat of through lack of multiple use of water resources is at Santa Fe. The Public Service Co. has three fine storage reservoirs in Santa Fe Canyon adjacent to the city. One above, on national forest land, is some 10 miles of good trout stream at the head of which is a magnificent little alpine lake.

All these waters are excellent fish habitat and the whole canyon has the attributes of a fine recreational area. But the entire watershed is closed up tight to protect the city water supply because the company has no filtration system. Many cities, including some in New Mexico, capitalize on their water supply reservoirs for fishing and recreation. San Diego, Calif., makes a big thing of it without endangering public health.

The New Mexico Department of Public Health says it would prefer to have regulated fishing and recreational use with a filtration system than to have the whole area closed to all use, as it is, without it.

Our contention is that where water is as scarce and as valuable for all purposes as it is in this State, it is just commonsense in the interest of the public to provide for multiple use of all our waters.

We wish to emphasize that water for fish and wildlife habitat and for recreational uses is as important to the public as any other use—we can drink beer, but we must have water for boating and fishing.

I thank you for the privilege of presenting this statement.

Senator ANDERSON. Thank you very much.

Mr. Worley, will you state your name please, sir?

STATEMENT OF GEORGE W. WORLEY, DIRECTOR, PACK FOUNDATION WATERSHED CONSERVATION EDUCATION PROJECT, UNIVERSITY OF NEW MEXICO

Mr. WORLEY. Senator Anderson, I am George W. Worley, director of the Pack Foundation watershed conservation project, a project made possible by a grant by the Charles Lakeford Forest Foundation to the University of New Mexico.

The committee has received, and will continue to receive, much detailed information relating to (1) the increased use of water to meet human needs; (2) existing and potential supplies of water; and (3) the technical aspects of conservation and development of water. Such information is basic to accurate analysis of water problems and planning for the solution of such problems.

While recognizing the essential nature of such data, this person feels compelled to suggest to the committee that there is danger of involvement in the physical and technical aspects of water development to the point where the human aspects of both problems and solutions may be partially obscured.

The major objective of any program of resource development is the provision of a satisfactory, regular standard of living for the people of the area involved. In a democracy, the people must have a part in planning and executing programs for the public welfare if the programs are to be effective and permanent.

The public must be involved in and must support a water resources development program. To insure this involvement and support, it is strongly urged that deliberate and adequate provision be made for an extensive and continuing program of public information and education relative to water and watershed resources, problems, conservation and development.

The effect and value of properly planned and executed educational activities conducted in connection with matters of concern to the public has been demonstrated on numerous occasions. The forest fire prevention program conducted by the U.S. Forest Service is one example. Commercial advertising is effective because the advertisers recognize the necessity of professionally planned and executed, and adequately financed "educational" campaigns.

In general, education on matters related to resource conservation and management has been inadequate. The necessity of providing for educational programs in public welfare projects has not been generally recognized. In spite of recent progress, the information-education activities of governmental agencies are, in general, relatively impotent. Effective, permanent, educational programs require highly skilled personnel, expensive equipment, and adequate funds for operation, if they are to successfully compete with commercial education and advertising for the attention of the public. The progress of some important public programs has been unnecessarily slow because the public has remained uninformed.

In planning water and watershed development, it should be realized that expenditures for educational activities should approach those for research, planning, consultation, and other activities leading up to execution of the ultimate program.

In relation to water development, the public must be informed on subjects such as the following if it is expected to be sympathetic to the program:

1. The watershed concept, that is, the natural adaptability to systematic planning and management of the physical units of land delimited by drainage.

2. The importance of improving the protection and management of upper watershed areas. In the West such upper watersheds, many of which are in the national forests, provide the major portion of the water available for human use in that area.

3. The generally poor condition of the lower watersheds in the West. These lower watersheds contribute very little usable water, yet are the source of nearly all the sediment reaching streams and reservoirs.

There is an urgent need for (*a*) classification of lower watershed lands as to condition and possible use; (*b*) protection of lower watersheds; (*c*) rehabilitation of damaged lower watersheds, and (*d*) research, soil surveys, utilization studies, and other matters related to inventories of lower watershed resources.

4. The responsibility of individuals in water conservation. Water, more than any other single natural resource, is susceptible to modification, waste, or conservation by every single individual in the world.

In conclusion, the committee is respectfully requested to recommend the inclusion, in a national plan for water development and conservation, of educational activities of unprecedented magnitude and intensity. No problem is more critical than that of providing for the future water needs of people. An informed and sympathetic public opinion can insure and expedite the solution of this problem.

Senator ANDERSON. I want to say the points you raise with reference to these various factors you must take into consideration are very valuable for the committee, and I thank you very much for being here.

Mr. WORLEY. Thank you, sir.

Senator ANDERSON. I want to make one brief statement about my senior colleague. As you know, in this work of being a Member of the Congress you have to do more than one job, "double in brass," I believe the people used to say. You have to play more than one instrument. Senator Chavez would have been very happy to be here except he was involved in the responsibilities of the Appropriations Committee, on which he is the third-ranking member. He is the ranking member of our committee in point of seniority on this select committee and I know he had definitely planned at the outset to be here and the date for the Albuquerque meeting was set with the idea in mind that Senator Chavez would be able to return from his trip in time.

I merely wanted to make a statement that I know he wanted to be here and participate. He has attended the committee meetings in Washington and he is very much interested in the work of this committee and in the activities of the session itself.

Senator ANDERSON. Now, the Bureau of Reclamation of course has long been one of our stalwarts. Ralph Charles and Chuck Clark are here. Would you stand up? Thank you very much.

I understand that John Thompson is here. He has been transferred, I believe, to Amarillo, I am sorry to say, but has been one of our stalwarts for a long, long time.

Mr. Thompson, it is satisfactory that this statement will be filed for the record.

Mr. THOMPSON. Thank you very much, Senator.

Senator ANDERSON. I thank you very much. You have been a fine, fine citizen for a long time.

(The statement referred to follows:)

STATEMENT OF JOHN C. THOMPSON, ASSISTANT REGIONAL DIRECTOR, REGION 5, OF THE BUREAU OF RECLAMATION

BUREAU OF RECLAMATION PROGRAM, NEW MEXICO REGION 5

I am John C. Thompson, assistant regional director of region 5 of the Bureau of Reclamation with headquarters in Amarillo. Until recently, I served here in Albuquerque as project manager in charge of construction of the Middle Rio

Grande project and on the Bureau's planning work east of the Continental Divide in New Mexico.

The Bureau's program in New Mexico is designed to assist the State and local people in making optimum use of the available water supplies. Our program recognizes that while in many areas water supplies are already fully used, in other locations opportunities remain for development of additional supplies through construction of storage and delivery works, and through salvage of waters now being nonbeneficially consumed.

We believe that New Mexico's future growth will be largely governed by the extent to which adequate, reasonably priced water is made available. We feel, therefore, that all measures offering promise of providing such water supplies merit consideration.

There are four major river basins in New Mexico, the Rio Grande, Pecos, Canadian, and San Juan. All are covered by interstate compacts which provide for division of the surface flows of these basins with adjacent States. In the Rio Grande and Pecos Basins, which involve about two-thirds of the State's area and population, the streamflows are fully appropriated and utilized. There the only significant opportunities for development of additional supplies lie in salvage of waters now being nonbeneficially consumed. The flows of the upper portion of the Canadian River Basin similarly are fully used. The San Juan River and lower reaches of the Canadian River constitute the only major undeveloped water sources of the State.

Starting in 1906, the Bureau helped develop the Rio Grande project and constructed Elephant Butte Reservoir. This was followed by the Carlsbad project on the Pecos. Starting in 1940, the Tucumcari project on the Canadian was built. These three projects brought in new lands totaling 226,000 acres.

In more recent years because of the limited water supplies, virtually all of the Bureau's construction program has been improvement of works to make more efficient use of water on lands already irrigated, and to salvage water being used nonbeneficially. As a part of this program, we have rehabilitated the irrigation systems of the Fort Sumner and Vermejo projects, and are now working on the middle Rio Grande.

Our middle Rio Grande project also includes channelization works consisting essentially of a low-flow channel and cleared floodway over a 184-mile reach of the Rio Grande, where high water losses due to use by native vegetation have occurred. Channelization has been completed through about 84 miles, with an estimated reduction in nonbeneficial use, or water salvage, since 1951 of about 350,000 acre-feet. Work is now underway on the remaining 100-mile reach. When completed, the channelization will save about 100,000 acre-feet annually.

This added water will provide appreciable benefits to the Rio Grande Basin, but will not meet the forecast basin water needs. In recognition of this fact, the Bureau has developed, in cooperation with the State of New Mexico, a plan for diversion of surplus water from the San Juan River Basin. The proposed San Juan-Chama project would involve an initial stage diversion of 110,000 acre-feet annually and a potential ultimate diversion of 235,000 acre-feet.

We are studying additional salvage possibilities on the Rio Grande and its tributaries above Cabello. There are many reaches of the river not included in our middle Rio Grande project which merit consideration for water salvage measures. We estimated that the nonbeneficial uses in such areas after completion of the authorized channelization work will total almost 350,000 acre-feet annually. A 5-year study now underway will isolate areas of greatest loss and outline plans for reducing these losses.

The Rio Grande, in the middle basin, is an aggrading stream. This has caused major water losses in the past; however, our studies indicate that with completion of the middle Rio Grande project channelization works and the reservoirs proposed by the Corps of Engineers, it will be possible to transport the sediment reaching the river, and to induce degradation as far downstream as the mouth of the Rio Puerco. Incomplete studies of the reach between the Rio Puerco and Elephant Butte Reservoir suggest that sediment retention somewhere on the Rio Puerco will be necessary.

The water supply problems of the Pecos River Basin have been exceedingly severe for some time and are increasing in gravity. Sedimentation of the Carlsbad project reservoirs has been a continuing problem since the project was built. Both McMillan and Avalon Reservoirs have been raised one or more times, and Alamogordo Reservoir, some 145 miles upstream, was constructed in 1938 to replace the depleted storage capacity. Recent studies indicate that the capacity of Alamogordo Reservoir may become seriously im-

paired in less than 40 years, and that additional terminal capacity likely will soon be required to replace that being lost in McMillan Reservoir.

Encroachment of salt cedars into the backwater area of McMillan Reservoir has resulted in formation of a delta, some 13,500 acres in extent, where high losses materially reduced the water supply to downstream users. Since 1949, with the help of the Bureau, the Carlsbad project has been opening up a low-flow channel through the lower reach of the McMillan Delta. This channel permits Alamorgordo releases and low-river flows to reach McMillan Reservoir.

Our McMillan delta project was authorized in 1958. The authorized plan provides for construction of a channel and cleared floodway through the delta area. The authorization provides, however, that the floodway not be started until feasible replacement is found for the present storage in McMillan Reservoir which would be depleted more rapidly by floodway construction. Recent studies have developed a feasible replacement site, and plans for the channel, incorporating features desired by the local people, are now being completed.

A recent study of the Pecos Basin found saltcedar infestation had increased alarmingly over the past 20 years. If it continues to increase at the past rate, in 50 years an amount of water approximately equal to the present average annual surface flows will be wasted. Eradication by mechanical means, together with annual inhibiting treatment, seems to offer the most promising solution to the problem. Because of the complex interrelationship of ground and surface waters in the Pecos Basin, it appears that an experimental program should be undertaken before any large scale attempts to eradicate these phreatophytes is made.

The absence of any opportunity for economical importation of additional water to the Pecos Basin emphasizes the importance of full consideration of potential salvage measures. These properly could include removing harmful salts to make more usable presently poor quality water supplies.

In addition to our major programs in the Pecos and Rio Grande Basins, we have underway studies of numerous small developments which offer promise of permitting more efficient use of the State's limited water supplies.

Senator ANDERSON. Mr. Robert Young of the Soil Conservation Service has a statement on water conservation activities in New Mexico, supported with a good deal of statistical data, and I think a very fine study of the situation.

That will appear in the record at this point with our thanks to him.

(The information referred to follows:)

STATEMENT OF U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, ALBUQUERQUE, N. MEX., PRESENTED BY ROBERT YOUNG

WATER CONSERVATION ACTIVITIES IN NEW MEXICO

The Soil Conservation Service as now organized in New Mexico consists of the State office, located in Albuquerque, five administrative areas, and 42 work units in the State. The Service, through memorandums of understanding, is cooperating with 58 soil conservation districts, and on the soil conservation and watershed areas in the Elephant Butte Irrigation District at Las Cruces, N. Mex. In addition, the Service maintains a State Soils Laboratory in cooperation with the New Mexico State University at University Park, N. Mex., and it is also cooperating with the New Mexico Agricultural Experiment Station in a Plant Materials Center located at Los Lunas, N. Mex.

The Service, as the technical soil and water conservation agency of the Department of Agriculture, administers Department of Agriculture activities involving technical assistance in soil and water conservation and flood prevention. It furnishes technical assistance to the soil conservation districts in the State, and provides needed technical assistance on permanent-type practices to farmers and ranchers who participate in the cost-sharing provisions of the agricultural conservation program. The Service maintains a close working relationship with the New Mexico State University, recognizing that the Department of Agriculture and the land grant colleges have an overall responsibility to make the State program of soil and water conservation effective. The Service looks to the New Mexico State Experiment Station and the Agricultural Research Service as principal sources for soil and water technology.

The Soil Conservation Service has responsibility for the Great Plains conservation program, which is designed to aid in the control of erosion and to bring about stabilization of the Great Plains portion of the State. The accomplishment of these objectives requires the application of effective measures for water conservation and for use of water resources.

The 58 soil conservation districts comprise an area of 65,038,210 acres, with 13,640 district cooperators under agreement. To date 10,540 basic conservation plans have been developed covering 25,016,502 acres.

Summary of water conservation practices completed under Public Law 46, 75th Congress, 1935

Total soil conservation districts		58
District acreage		65, 038, 210
SCD cooperators		13, 640
SCD cooperators acreage under agreement		32, 862, 290
Basic plans:		
Number		10, 540
Acres		25, 016, 502

SOIL AND WATER CONSERVATION PRACTICES TO DATE

Proper range use	acres	16, 029, 191
Grass seeding	do	725, 122
Improved water application	do	318, 295
Irrigation water management	do	124, 891
Terracing	miles	5, 558
Irrigation pipeline	lineal feet	3, 974, 072
Ditch construction	miles	5, 585
Concrete ditch lining	lineal feet	3, 620, 115
Diversion dams	number	15, 136
Diversion dikes and ditches	miles	3, 549
Land leveling	acres	229, 070
Pond construction:		
Livestock	number	13, 437
Irrigation	do	2, 400
Small irrigation structures	do	61, 304

GROUP JOBS

27 groups drainage jobs	acres	6, 335
269 group irrigation jobs	do	174, 283
37 group erosion control jobs	do	35, 759
Ditch construction	miles	179. 3
Ditch lining	lineal feet	16, 086
Diversion dams	number	184

SURVEYS

Standard soil surveys	acres	4, 367, 351
Soil conservation surveys	do	1, 587, 249
Range site surveys	do	12, 652, 048

The major job of the Soil Conservation Service in New Mexico is to assist landowners and operators in the 58 soil conservation districts plan and apply conservation programs which fit their lands. Farmers and ranchers are being assisted in making the most efficient use of the water that falls on their land. Through the application of conservation farming practices the amount of rainfall that enters the soil is increased and at the same time runoff is retarded, which helps to prevent peak floods in the downstream areas. This also helps keep sediment out of streams and reservoirs.

New Mexico has faced water problems since the early Spanish exploration. Conservation of the State's soil and water resources is a matter of utmost urgency. Soil and water are the most important resources in the State's present and future welfare. Good progress is being made by farmers and ranchers in effecting higher efficiencies in the control and use of water on the 873,000 acres of irrigated land.

Farmers and ranchers, Federal, State and local agencies concerned, and in many places urban people, are cooperating in an all-out effort to conserve and improve our soil and water resources. Probably the greatest improvement has

been made on irrigated lands where much of the land has been leveled, and irrigation facilities, such as ditches, pipelines, and other water control structures, have been installed. The main conservation job remaining on irrigated lands is to improve water management to conserve a limited water supply.

Major water conservation practices being applied to farmlands are improved water application, irrigation water management, ditch construction, irrigation pipelines, ditch lining, irrigation reservoirs, small irrigation structures, improved systems of field laterals, diversion dams, diversion dikes and ditches, terracing and livestock ponds.

The Soil Conservation Service also devotes major attention to correct handling of plant resources to enable operators to produce maximum crops of range forage, timber, and cultivated crops. Sound cultural management practices produce good crops and provide soil cover for orderly control and disposition of available water.

PROGRESS IN WATERSHED WORK

To help meet the needs of New Mexico farmers and ranchers faced with erosion and flood problems on their agricultural lands, the Soil Conservation Service works through soil conservation districts and other local organizations and cooperating agencies in carrying out the watershed protection and flood prevention program under Public Law 566, passed by Congress in 1954.

Watershed protection and flood prevention projects on watersheds up to 250,000 acres in size are initiated in the State by local organizations, such as soil conservation districts, having authority to sponsor such projects, and to operate and maintain such works of improvement as may be installed. The Federal Government furnishes technical and financial assistance under the program. The Soil Conservation Service cooperates with local, State and Federal agencies concerned with land and water management to achieve a coordinated effort in the watershed protection program.

The State government plays an important part in the program, with the State engineer's office as the designated State agency responsible for the program in New Mexico. All applications for assistance under the watershed program must be submitted to the State engineer for his approval before any action is taken by the Soil Conservation Service.

New Mexico ranks near the top of all States in progress under the watershed program. To date 46 applications for assistance have been submitted from 19 counties; 10 of these projects have been approved for operations.

Project	Location	Date approved
1. Hatch Valley Arroyos	Dona Ana and Sierra Counties	June 6, 1956
2. Dona Ana	Dona Ana County	July 2, 1956
3. Upper Rio Penasco	Otero County	June 3, 1957
4. Zuber Draw	Chaves County	Mar. 4, 1958
5. Caballo Arroyos	Dona Ana and Sierra Counties	May 5, 1958
6. Tramperos	Union and Harding Counties	July 2, 1958
7. Prop Canyon	Valencia County	Oct. 2, 1958
8. Saltpeter Creek	Colfax County	Apr. 1, 1959
9. Pecos Arroyo	San Miguel County	June 1, 1959
10. Santa Cruz	Santa Fe, Mora, and Rio Arriba Counties	Aug. 6, 1959

The work done in a watershed program will fall into two broad general classifications: Structural works of improvement and upland conservation measures.

Under the structural program the Federal Government pays all costs of construction for flood prevention and control. The Soil Conservation Service, as the designated technical agency, makes the necessary engineering surveys, prepares designs and specifications, and supervises construction. The sponsoring local organization provides the land and easements for the structural measures, lets the contracts for all structures, and assumes the responsibility for operation and maintenance of the structures.

Planning has been initiated on 16 watershed projects in New Mexico covering an area of 1,502 square miles. Work plans have been completed and authorization for construction has been obtained for 10 of these projects covering an area of 980 square miles. Structural works of improvement planned for these watersheds include 32 floodwater-retarding structures which will store and gradually release 13,670 acre-feet of floodwater runoff. In addition, all of these structures

will store the sediment which is expected to accumulate during a 50-year period. These structures will be built at an estimated cost of $1,935,000.

In addition to the structural measures, local farmers and ranchers will install 1,400 check dams, 900 acres of contour furrows on rangeland, 350 diversion dams, 1,300 erosion-control structures, 100 miles of terraces, 35,000 acres of range pitting, and will seed 12,000 acres of rangeland to grass. These measures will control erosion and floodwater runoff from the flood source areas and will be installed at a cost of $500,000.

Cost-sharing assistance in stalling many of these conservation measures will be provided under other programs, such as the agricultural conservation program, the conservation reserve program, and the Great Plains conservation program.

The Forest Service and the Bureau of Land Management will install conservation measures on lands administered by those agencies as a part of the watershed program. Costs of these measures are provided for under Public Law 566.

Construction has been completed on two projects in New Mexico—the Hatch Valley Arroyos project in Dona Ana and Sierra Counties and the Dona Ana Arroyos project in Dona Ana County. Both of these projects were completed in 1958. A floodwater-retarding structure built as a part of the Hatch project was the first structure in the Nation to be completed under the Public Law 566 watershed program.

In addition to the Public Law 566 projects, major structural works of improvement have been completed on the Bernalillo project and the upper Rio Hondo project, authorized as pilot watersheds under the small watershed protection program.

Operations are currently underway on the upper Rio Penasco and the Caballo Arroyos projects. Two of the three planned sites have been completed on the upper Rio Penasco project and the third site is planned for completion in fiscal year 1960. Three of the five planned sites have been completed on the Caballo Arroyos project, and it is planned that the two remaining sites will be completed in fiscal year 1960.

Construction is currently underway on one of four sites planned on the Zuber Draw project in Chaves County. Plans are for a total of three of the four sites to be completed during fiscal year 1960.

Negotiations are now in process leading to issuing bids for constructing one of the two sites planned for the Tramperos Creek watershed project in Union and Harding Counties.

Work plans have been completed on the Tortugas Arroyo watershed in Dona Ana County and the upper Gila Valley Arroyos watershed in Grant County. Planning is well advanced on the Pojoaque Creek watershed in Santa Fe County and the upper Dry Cimarron watershed in Union County. Planning was initiated in November 1959 on the Fillmore-Apache Arroyos watershed in Dona Ana County and the Lemitar-Polvadera watershed in Socorro County. Planning will be initiated on two additional watersheds early in fiscal year 1960.

Senator ANDERSON. I am just going to call Ken Schroeder from Denver. I believe Mr. Schroeder is here.

Mr. SCHROEDER. Yes, sir.

Senator ANDERSON. Thank you, Mr. Schroeder. Did you desire the statement appear in the record at this point or did you want to read portions of it?

Mr. SCHROEDER. I do not care to read portions of it. I think Mr. Reynolds said everything for us of the Bureau of Reclamation this morning. So, if you like, it may be included in the record.

Senator ANDERSON. It will be included in the record.

Mr. SCHROEDER. It has some things to do with our research projects on evaporation reduction and so on.

Senator ANDERSON. That is a very interesting subject and I want everybody to know that the Bureau of Reclamation is one of our really tremendous industries in this part of the country.

I have many times spoken to them about the value of these great Government agencies in the life of the West—the Army Corps of Engineers, the Bureau of Reclamation, the Forestry Service, the

Taylor Grazing Act people. I do not know what we would do with this enormous area, millions of acres of land, were it not for these very fine professional groups of people involved in these agencies that service us.

(The statement referred to follows:)

STATEMENT BY K. B. SCHROEDER, U.S. BUREAU OF RECLAMATION, DENVER, COLO., ON WATER LOSS AND SEDIMENTATION IN THE STATE OF NEW MEXICO

WATER LOSSES

There are certain water losses associated with water resource project development that do not contribute directly to the prime purposes of the project. These losses, in general, are associated with storage of water, conveyance of water in river channels and canals, and in the application of water to irrigated areas. These items will be discussed separately.

When water is impounded in reservoirs for the purpose of storing or holding it for use as needed, certain losses are experienced. The major loss is usually that associated with evaporation from the reservoir surface. Evaporation from a reservoir surface may not be a total new loss considering the use in the area before the reservoir was constructed. However, the evaporation after construction is an identifiable existing loss. Another loss associated with reservoir impoundment is that water used by the vegetative growth that develops around the periphery of the reservoir. This loss can be particularly high in the delta areas of reservoirs. As sediment deposits in reservoirs, it may build a fan or delta at the head of the reservoir or wherever streamflow is entering the reservoir area. Cottonwoods, willows, and Tamarisk (salt cedar) are particularly adaptable to growth in these areas. This phreatophytic vegetation is most prevalent in lower elevations and warmer climates. It consumes large amounts of water during the warm weather period when the water table is high. Another loss associated with storage is that of seepage around the dam. Not all seepage can be considered as a loss. Seepage that accrues to the stream or that can be collected in drains and conveyed immediately back to the river channel below the dam will be available for downstream use. The net loss is usually attributed to seepage accruing to new areas within the flood plain that previously did not support vegetation or have evaporation from swamp or ponded areas.

River valley conveyance

Water is always lost in river valleys and from the river channel. Some water loss is inevitable and has been experienced throughout the life of the valleys. There is evaporation directly from the stream water surface, from the channel edge, and from wetted soils and sandbars. Streams having wide flat channels and shallow depths present a larger exposure for evaporation than narrow, deep and fast-flowing streams.

Vegetative growth usually adjacent to the stream is another source of loss. A stream channel may be associated with the valley developed in geologic time; some channels are narrow and deep and others are wide and flat. Floodflows conveyed by a river in narrow deep valleys experience less loss than streams in wide flat valleys where floods inundate a considerable extent of the valleys. Large vegetative growth areas in the wide flat valleys may be irrigated during flood periods or by subterranean flow bed by channel seepage. Such streams normaly experience considerable amount of loss. In certain cases streams with wide valleys and shallow main channels will maintain a high water table beneath the adjacent flood plain and valley area. Vegetative growth in the flood plain is continually irrigated by water from the stream or by ground water from the higher adjacent areas. Phreatophytic growth, such as cottonwoods, willows, and tamarisk will consume a large amount of water in valleys of this type.

In a few instances, the water table below streambeds may be at considerable depth. This is particularly true on streams that do not have perennial flow. A portion of the water conveyed during floodflow periods would be lost from the stream to the lower ground-water table. This is not necessarily a net loss as this water accruing to the deeper ground-water basin would be available at some other point either farther down the valley or in an adjacent valley.

Conveyance in canals and artificial channels

Irrigation of any area requires the conveyance and distribution of water to the farmlands. This is done primarily through a system of canals and laterals. In the operation of these systems there are wastes incidental to furnishing each farmer a supply of water as required. These wastes are normally termed "operational wastes" and are caused by the inability of the operators to predict accurately the losses through seepage and evaporation from the canal together with releases past diversion points at the time of the changing point of use. The wastes are usually discharged in specially prepared wasteways that are conveyed by other artificial or natural channels back to the main river. Operational wastes are not a net loss but are available as they reach the main channel for use downstream. However, it is inevitable that some of the waste flow will be lost in conveyance to the main channel. This takes place as evaporation loss from the water surface area of the channel and as evaporation and transpiration due to vegetative growth immediately adjacent to the channel. These losses cannot be retrieved. Canals constructed through the irrigated areas are usually higher than the ground-water table in the area. Seepage is always experienced from a canal in varying amounts. Seepage in sandy soils is, of course, higher than seepage in the tighter clay soils. Seepage loss in canals will either continue vertically to the ground-water table and be recoverable through pumping or move to natural channels and be available for downstream use. In certain instances these losses are moved laterally and support additional growth in swamps or waterlogged areas, in which case the loss is irretrievable.

Irrigated areas

Water used consumptively is that water used on the farm area through transpiration by crops or by direct evaporation from the soil surface. This consumptive-use water is supplied from precipitation and the application of irrigation. Irrigation water is not always uniformly applied. Often it is applied in amounts greater than the soil profile can store within the root zone of the crops. When the root zone area is supersaturated either by irrigation or precipitation, the excess water percolates vertically to the water table beneath the land. Water thus reaching a shallow water table will move laterally to some natural channel, be available for pumping, or break out as springs or seeps in surrounding low areas. There are losses of this water as it wets natural channel areas that were previously ephemeral. Water is lost as it breaks out into the lowlands. The common term is "new seeped area." If the water does not move laterally in the underlying aquifer and discharge to a natural channel, drains may be required to move the water artificially out of the irrigated area. There are losses from drains as in any natural channel.

The Bureau of Reclamation has constructed nine reservoirs in New Mexico and one is presently under construction. The 10 reservoirs will impound about 4,638,000 acre-feet of water. The water surface area of these reservoirs at full capacity is about 80,000 acres. Table 1 lists these reservoirs, the project, location, capacity, water surface area, elevation, and provision for sedimentation. Annual evaporation from the water surface of these reservoirs at full capacity is about 420,000 acre-feet. Evaporation under actual operation is about 150,000 acre-feet annually. Most of the reservoirs in New Mexico receive appreciable amounts of sediment and build large delta areas. These delta areas provide excellent conditions for phreatophytic growth. The Bureau has constructed special channels and cleared large areas of phreatophytic infestation at the head end of Elephant Butte Reservoir.

A similar project for elimination of this water loss has been authorized and is being readied for construction in the McMillan Reservoir delta area. The other reservoirs operated by the Bureau of Reclamation are being observed, and it is anticipated action will be taken to eliminate delta losses when they become serious.

The Bureau of Reclamation is presently supplying either supplemental or full irrigation water supplies to approximately 250,000 acres in New Mexico through six project developments. The Bureau has approximately 1,900 miles of canals and laterals in operation in the State and there have been constructed approximately 900 miles of open drains on these projects. The net water loss from irrigated areas is not as great as shown in project maintenance reports. Much of the water so reported returns to natural channels and is available for downstream use, reclaimed from the drains, or is pumped from the underlying aquifer. The supply of water available for irrigation in New Mexico is normally short and the farmers are careful in the use of their supplies. In 1957, the

Bureau projects in New Mexico had an average net water supply of only 2.41 acre-feet per acre at diversion.

Probably the greatest water loss problem in the State of New Mexico is that associated with phreatophytic growth in the relatively shallow water table valley areas. This problem is described in the paper entitled "Phreatophytes and Water Salvage" by Mr. Jack C. Koogler of the New Mexico State engineer's office. Mr. Koogler estimates that approximately 441,000 acres in New Mexico are infested with phreatophytes using approximately 870,000 acre-feet of water annually. A major portion of this nonbeneficial consumptive use occurs in two of the most important and productive stream systems in New Mexico, the Rio Grande and the Pecos River. The Bureau of Reclamation is presently constructing and has partially completed a special conveyance channel from the San Acacia diversion dam to Elephant Butte Dam on the Rio Grande. It is estimated in this 88-mile reach of the Rio Grande that approximately 160,000 acre-feet of water is lost annually. Although only partially in operation during the period, it is estimated that the channel works constructed by the Bureau of Reclamation have salvaged the following amounts of water:

Water year:	*Estimated salvage, acre-feet*
1951 [1]	14,000
1952	19,200
1953	36,970
1954	29,410
1955	59,060
1956	65,110
1957	40,670

[1] June through September.

Under the Middle Rio Grande project authorization, there is proposed a total expenditure of approximately $13,500,000 for channel improvement work extending from Elephant Butte Reservoir to approximately the mouth of the Rio Chama. This includes the work already under construction or completed below San Acacia diversion dam. While some water salvage may be expected in the channel rectification work above San Acacia diversion dam, the prime requisite is flood and sediment control. This will be discussed later under "Sedimentation." In addition to the channel rectification work in the Middle Rio Grande area, the Bureau is presently rehabilitating drains and canal systems for the project area. Cleaning and deepening of drains and provision for reuse of the drainage water for irrigation is being accomplished where possible. A comprehensive investigations program is now being started in the Rio Grande Valley extending from Elephant Butte Dam to the headwaters in Colorado, aimed primarily at possible water salvage. There has been completed a basin inventory of water losses and possible means of salvage in the Pecos Basin. This report is presently under review by interested parties in New Mexico and Texas and will be submitted to the Secretary of the Interior in the near future.

The Bureau has been conducting research activities on the possibility of applying a thin protective film on reservoir surface areas to reduce evaporation. Experiments to date show that from a practical point of view, we may be able to achieve some success in this field. The results of this study are contained in a report entitled "Water Loss Investigations, Lake Hefner, 1958, Evaporation Reduction Investigations." We are also continuing research in the field of canal lining. The aim of this research is to achieve an effective low-cost lining. As outlined in Mr. Koogler's paper, the Bureau is also continuing in cooperation with the Geologic Survey special research investigations on phreatophyte water uses and methods of salvage. We also hope in the near future to obtain sufficient research funds to conduct a comprehensive evaluation of the actual channel salvage between the San Acacia diversion dam and Elephant Butte Dam.

SEDIMENTATION

The natural processes of sedimentation rarely benefit water resource project development. Hence, the effect of sedimentation is a problem that must be forecast and the cost for handling added to the overall project. The problems encountered are reservoir deposition, deposition in canals, and the effect upon natural channel regime.

Reservoir deposition

Sediment carried into reservoirs by the inflowing streams deposits in the reservoir pools and depletes space available for storage. Experience has shown this accumulation does not conveniently fill a dead storage pool in the lower part of the reservoir but deposits throughout the reservoir and depletes the upper

usable space. In certain instances, large sediment deposits will occur at the head of the reservoir, creating delta areas. The policy within the Bureau is to provide extra storage in reservoirs for sediment deposition. Generally, 100 years of deposition space is provided before encroachment upon the space required for project storage. This is a matter of economics and each reservoir is studied individually for the proper balance. Consideration is given to possible replacement, value of the damsite, and use of the space during the depletion period. The problem is forecasting the deposition rate and distribution of sediment within the reservoir. Sediment sampling is the basis for forecasting most of the yield rates. Methods of forecasting yield rates and distribution within reservoirs have been developed by the Bureau and are empirical and based upon past experience. A limited amount of research money is being spent cooperatively with other Federal agencies to perfect these procedures. The particular problem being studied at present is the formation of reservoir deltas. When large deltas form at the head of the reservoir, they may damage existing facilities above the reservoir level and provide an area for phreatophytic vegetation and resulting water loss. If we can forecast the delta formation with a reasonable degree of accuracy, additional rights-of-way will be purchased and maintenance provided to combat the potential water losses. At present there is much to be learned about forecasting delta formation.

Deposition in canals

Direct diversion of streamflows to irrigation distribution systems will divert both sediment and water. Canal systems as a rule have much flatter slopes than streams; hence, the sediment will deposit in the canal and cleaning is required to maintain canal capacity. When sediment load is forecast, designs are altered to handle the problem. The Bureau's policy is to prevent large amounts of sediment from entering the canal system. This is done by specially designed excluders at the diversion headworks or use of settling basins at the head of the canal. Sediment deposited in canal settling basins is removed by dragline or dredge.

Stream regime

The problems of stream regime are now becoming apparent in many areas and particularly so in New Mexico. The problems arise from stream degradation and aggradation. Use of clear water from the mountain areas for irrigation or other purposes means this water is no longer available to transport sediment yields from the desert areas and lower basins. In addition, there are strong indications that modern land use of the desert areas has increased the sediment yields from these areas. The resulting stream channel aggradation raises valley water tables, thus increasing drainage problems and water losses from the valley.

As explained previously, there are irrigation losses and wastes associated with delivery of water to irrigated lands. When an irrigated area is at a much higher elevation than the main valley channel, a problem is encountered in returning these wastes to the lower valley. The natural channels draining the high areas were in a relatively stable regime before irrigation, but irrigation wastes combined with natural stormflows will, in many cases, seriously erode these channels. We have found that artificial control of these channels is necessary and must be included as a project cost. In some cases, it has been necessary to do this type of work on old operating projects because it was overlooked in the initial plan.

Bureau developments in New Mexico

The existing reservoirs built by the Bureau in New Mexico have presented difficult sediment problems. The attached table shows the annual sediment rates for reservoirs in New Mexico, and it may be noted the deposition rates in many of these are large. Sediment rates in New Mexico vary from approximately 0.2 acre-foot per square mile up to about 1.5 acre-feet per square mile of drainage area.

One of the main problems in New Mexico is that of channel regime. The Bureau is presently rectifying the Rio Grande Channel from approximately the mouth of the Rio Chama to Elephant Butte Reservoir. This channel has shown a consistent aggradation. The Corps of Engineers estimates that if this channel is not controlled, it will aggradate approximately 3 feet in the next 50 years. The attached table shows a summary of Corps of Engineers observed aggradation of the river by reaches. We believe the plans proposed and presently under construction will correct this problem. Associated with the channel

problem in the Middle Rio Grande area is that of sediment in canals. The Bureau has constructed a settling basin and installed a 10-inch dredge at the San Acacia diversion to the Socorro Main Canal. This dredge will remove between 200,000 and 300,000 cubic yards of material annually and prevent settling in the canal. We have under construction a settling basin at the Isleta diversion to the Peralta Main Canal. A 10-inch dredge capable of moving approximately 70,000 cubic feet of material annually is being installed at this location.

It is anticipated that other aggradation problems may become acute in New Mexico river basins, and it is hoped from the experience gained in the channel rectification work in the Rio Grande and Pecos River Valleys that these problems may be solved expeditiously as they occur.

Summary of void changes in the channel and flood plain—Rio Grande

Division	Period between surveys	Area (acres)	Net change (acre-feet)	Rate of change (feet per year)	Feet
I. Cochiti	Channel	2,057.5	−1,515	−0.043	−0.74
Cochiti diversion dam to Angostura diversion dam.	Flood plain	2,049.4	+1,810	+.052	+.88
	Channel and flood plain	4,106.9	+295	+.004	+.07
	1937–54 (17.016 years).				
II. Albuquerque	Channel	4,286.3	+1,153	+.017	+.27
Angostura diversion dam to Isleta diversion dam.	Flood plain	4,183.9	+4,582	+.068	+1.09
	Channel and flood plain	8,470.2	+5,735	+.042	+.68
	1936–53 (16.192 years).				
III. Belen	Channel	7,704.0	−2,575	−.020	−.33
Isleta diversion dam to San Acacia diversion dam.	Flood plain	5,575.0	+3,284	+.035	+.59
	Channel and flood plain	13,279.0	+709	+.003	+.05
	1936–53 (17.022 years).				
IV. Socorro	Channel	4,203.0	+2,614	+.037	+.62
San Acacia diversion dam to San Antonio, N. Mex.	Flood plain	4,264.0	+1,520	+.021	+.26
	Channel and flood plain	8,467.0	+4,134	+.029	+.49
	1936–53 (16.770 years).				

PERTINENT REFERENCES

(*a*) "Report on storm of September 20–30, 1929 (SW2–28), New Mexico and Colorado, pt. 1," U.S. Army Engineer district, Albuquerque.

(*b*) EM 1110–2–1405, "Hydrologic and Hydraulic Analyses, Flood-Hydrograph Analysis and Computations," dated March 1948 (Engineering Manual, pt. CXIV, ch. 5), Corps of Engineers.

(*c*) EM 1110–2–1408, "Hydrologic and Hydraulic Analyses, Routing of Floods Through River Channels," dated September 1953 (Engineering Manual, pt. CXIV, ch. 8), Corps of Engineers.

(*d*) "Progress Report of Hydrologic and Economic Study," dated September 1952, by Joint Special Study Group, Arkansas-White-Red Basins Inter-Agency study.

Bureau reservoirs in New Mexico

Reservoir	Project	Acre-feet capacity	(Acres) surface area	Elevation	River	Annual ac-e-feet sediment yield
Caballo	Rio Grande	344,000	11,600	4,182.0	Rio Grande	94
Elephant Butte	do	2,206,800	36,600	4,407.0	do	10,200
Reservoir No. 2	Vermejo	2,900	420	6,147.8	Offstream Canadian.	77
Reservoir No. 13	do	5,000	336	6,046.5	do	72
Stubblefield	do	16,100	1,150	6,133.0	do	77
Alamogordo	Carlsbad	122,100	4,570	4,275.0	Pecos	2,050
Avalon	do	5,100	950	3,177.4	do	40
McMillan	do	32,900	5,180	3,266.5	do	825
Navajo [1]	Colorado River storage	1,709,000	15,600	6,085.0	San Juan	3,300
El Vado	Middle Rio Grande	194,000	3,220	6,902.0	Rio Chama	300
Total		4,637,900	79,606			

[1] Under construction.

Senator ANDERSON. Also, I want to announce, when we have finished with the two remaining witnesses and the meeting adjourns, that anyone who desires to submit a statement for the record is privileged to do so. That does not mean that we promise that everything that is submitted will be printed. I had a man telegraph me one day and ask if I would tell him about the outdoor attractions of Washington.

He being a good friend of mine I thought that he would enjoy a practical joke. I took down a copy of the Washington Guidebook on the Washington Monument and sent it collect. He got more than he wanted.

We would probably get more than we wanted if we opened the gates completely to everyone. We do sincerely desire and I speak for Senator Kerr and the other members of the committee that statements do reach us from the interested agencies and everyone who desires to do so may send to us an expression of his point of view which I believe the staff would try to incorporate as fully as possible into the final record.

Hubert Ball and John Murphy, do you want to come up also? What a pair these two individuals have been for the cause of water conservation and water development in the Southwest!

STATEMENT OF HUBERT T. BALL, CHIEF ENGINEER, MIDDLE RIO GRANDE CONSERVANCY DISTRICT

Mr. BALL. Mr. Chairman, members of the committee, and others present, my name is Hubert Ball; I am chief engineer of the Middle Rio Grande Conservancy District. The district is an entity, whose operations in connection with various projects now underway and which have been constructed in the past, extend over an area of some 300 miles in length through the central part of New Mexico along the Chama and Rio Grande Rivers.

The main offices of the district are located in Albuquerque, N. Mex., and we are charged with the responsibility of irrigation, drainage, and flood control throughout a major portion of this area.

There is located within the immediate district boundaries 121,000 acres of land with more than a one-quarter of a million inhabitants. In this acreage and population are included portions of six Indian Pueblos and major portions of the cities of Albuquerque, Socorro, Belen, and numerous other towns and villages such as Bernalillo, Los Lunas, and so forth.

I have been connected with the district for 22 years and have served on the resolutions committee of the National Reclamation Association for a considerable portion of that time. Before that time, I was connected with the Government in various capacities in which I had numerous contacts with the irrigation, drainage, and flood control problems throughout New Mexico.

During these 30 years, I have had the privilege and the pleasure of representing this district and area before many congressional committees and other bodies that direct and coordinate activities concerned with conservation and development of water resources in the reclamation area. During these years of experience and connection with these problems, I have arrived at the following personal conclu-

sions, which have not been developed hastily and recently, but are the result of long study and considerable personal knowledge of numerous projects throughout the entire Southwest. I will try to point out these problems most briefly, since I am sure that I am not alone in my conclusions but am joined by many other witnesses that have appeared before you in the past and whom you will undoubtedly hear in the future.

I would like to devote the first portion of this statement to our immediate local problems. The Middle Rio Grande area is one of the most rapidly developing areas of suburban growth in the United States. The population increase here is among the three or four highest in percentage rate of any of those throughout the entire country and industrial development which would pyramid this continued growth is only being retarded by the lack of water. I believe our immediate area has the most favorable climate for both urban and industrial development of the 50 States. The delays brought about by inclement weather, which are experienced in so many localities, are no problem throughout the central and southern part of New Mexico.

We also have other natural resources, such as oil, natural gas, coal, gypsum and uranium deposits which are most essential to industrial developments and are urgently required in the national defense which we all agree is the No. 1 problem facing our country today. All of these resources, which are readily available to local industry have encouraged the development in this area of many atomic energy installations.

These developments can only continue to exist if there is sufficient water within the immediate area to allow the increase of related domestic and industrial use which naturally follows such an intensive program of progress and development.

There are several projects which would be of great aid and assistance to this program. However, three are directly connected and certainly vital to the continued well-being of this area. The requirement for water can best be met through the development of the San Juan-Chama transmountain diversion project which was authorized in the last Congress by the Senate and we trust will be considered by the U.S. House of Representatives very early in the next regular Congress.

This project is a participating project in the Upper Colorado Basin development program and would supply water for industrial and domestic development along the Rio Grande and Chama Rivers above Elephant Butte Reservoir in New Mexico. This project would also furnish a considerable amount of water to be used for supplementing irrigation uses within the same area which has been plagued by repeated drought since 1943.

The growth and development of this area most certainly depends on the progress of this project. Since abundant supporting evidence by both the Government and local political subdivisions is available to you at this hearing and in the records of Congress, I shall not attempt to repeat that which would only be a burden on your time and that of the other people at this hearing.

The second problem concerning this valley is the flood damage which results from rapid melt of snow in the mountains during the

spring months. Such floods are a constant threat to the present industrial development and people of the middle Rio Grande area. The middle Rio Grande project, which is now under construction includes completion of the levee program within the Middle Rio Grande Conservancy District, continued channelization of the river, and construction of dams on the Rio Grande and tributaries which would allow control of the riverflow at all times during the year. It is essential that this program be completed to furnish sufficient protection to allow the people of our area the peace of mind which comes when they feel that they can live in safety during high flows on the Rio Grande. The floods, which we have experienced at regular intervals in the past and which I am sure we will experience in the future, have many times caused untold suffering and much damage to the local people, and to their possessions. The cost of repairing flood damage has almost bankrupted the local political subdivisions numerous times in their continuous fight to protect the people in this area from this ever-present menace.

The third most important problem in this area in my opinion is the control of the arroyos which should be coordinated with an intensive program by the Soil Conservation Service of the United States. The arroyo problem in this area arises from the flash floods which are brought about by intense summer rains falling on the small side drainage areas of the river. While these areas are not large, they certainly are a menace to local development at numerous locations throughout the district.

This is a problem which is present in many urban areas in the West and certainly will be most expensive to correct. However, I believe that this committee should encourage more study and development of these projects by all governmental agencies. The solution of these problems will certainly require the cooperation of all local public institutions since generally the effect is felt locally rather than nationally. Although damages from arroyo floods are usually local, the widespread damage that can be caused by infrequent general rains certainly is a problem which the Congress would be justified in directing widespread efforts to control.

I would like to devote a few more minutes of my time and ask your indulgence while I present a few observations of other problems with which I have become familiar during the past several years of association with the people of our area and of other States and regions. While these problems apply to us in this district they also apply to the entire area west of the Mississippi. I will not attempt to make detailed statements regarding these matters as I am sure there are others appearing here, whom I consider to be more competent witnesses, who will discuss these problems in greater detail.

First, I would like to discuss the possibility of recreation facilities being established in connection with flood control and reclamation projects in the semiarid regions of the West. Recreation activities, such as fishing, boating, swimming, and hunting, certainly are becoming big business throughout the United States and it definitely is of national importance to provide suitable recreation areas. Industrial development throughout the country has been stimulated by the desire of the people to engage in these activities and to purchase the many manufactured articles used in these recreational activities.

Such articles are usually manufactured in areas far removed from the point where they are actually finally used and those areas benefit from the increased industrial activity. This fact certainly should receive consideration by the Government.

Another factor to consider is that the local people using these facilities are generally a very small percentage of the total users. We believe that these facilities should receive the same consideration as other nonreimbursable items which go into the planning and construction of the average reclamation, flood control, and conservation project.

The second item which would be of particular interest to the State of New Mexico, and which I understand would be of considerable interest to the projects of our neighboring States of Colorado, Texas, Oklahoma, and so forth, would be a program by the Federal Government to determine flood control and recreation benefits of projects which are constructed by local public funds.

It seems to me that this should receive consideration since I think the Government could justify such action. Certainly local people should not be penalized by having to construct these facilities without such aid since all other projects of a like nature, when constructed by Federal funds either by loan or direct grant, have the advantage of nonreimbursable allocations to such purposes.

Third, it seems to me that the Congress would be justified in emphasizing the program of general research and laboratory investigation necessary to guide the program of soil conservation and water resources development, particularly by those agencies which are now engaged in such studies.

There seems to be some inclination on the part of some people I have known in the past in various governmental positions to believe that if general research programs were reduced it would result in a reduction in the cost of flood control and reclamation projects that would be followed by reduction in national expenditures for this vital program. It seems to me that this is a very nearsighted policy and will result in the country waking up someday to the fact that they have carried on development piecemeal and that all of these pieces do not fit into the completed program where they would be of the most benefit both nationally as well as locally.

I could continue to speak on these subjects for a considerable time, however, I know that you desire to hear many other witnesses and that undoubtedly reams of evidence on these particular matters will be presented which will support these views.

There is one particular item that I believe is sufficiently important to emphasize in closing. That is, the recent policy of the Congress to require that the interest bearing allocations on water development projects and other similar programs be charged interest at the same rate as that payable on the outstanding long-term Treasury obligations throughout the United States at the particular time that a project is authorized and funds appropriated therefor.

This is the most insidious way of stopping water development in the West that it would be possible to promote. I would like to protest vigorously this particular program and ask that your committee devote sufficient time apprising themselves of the inevitable result of this policy. I am sure that your studies will convince you that this

policy is unwise and I hope you will recommend reconsideration of this decision because of its detrimental effect upon the program for which your committee has been formed.

I wish to thank the chairman and members of your committee and your staff for all past favors. We hope that you have enjoyed your visit in Albuquerque and the surrounding areas and particularly hope you have enjoyed seeing our town and those areas of the Middle Rio Grande Conservancy District which you have had the opportunity to inspect. I heartily invite you to return at any opportunity and again thank you for your kind consideration.

Senator ANDERSON. Thank you.

The interest problem has been extremely difficult. We appreciate the support we have had from local irrigation groups throughout the West and the effort is going to continue to change this situation so that these projects are feasible.

At the time that the Colorado storage project bill was passed, the Treasury recommended a method of judging feasibility that included the yield on long-term bonds. We tried to have them make it the coupon rate and they said it would be to our advantage to keep it on the basis of yield, and that that would meet the national policy and that rate would satisfy the Bureau of the Budget.

It turned out that the rate on long-term bonds was going to go at 4 percent and to show you how difficult it could be, Hoover Dam as a very wonderful engineering project and one of the most valuable projects we have ever built in the United States is completely infeasible with 4-percent money, with 3¾ money, even with 3½-percent money. So if they asked us to develop the upper Colorado storage project which does not have the fortunate sites nor the great outturn of returns by the sale of electricity and the supplying of water for domestic purposes to Los Angeles, they could not make it, how in the world they could expect the upper Colorado storage project to make it, I do not know.

Therefore, I am very happy that the Senate has passed an amendment which relieves this situation somewhat. It will be a matter of continuing study by the western Senators, I am sure by the Bureau of Reclamation, by the Army Corps of Engineers and others, as to what we can hereafter do on interest rates to make these great and important projects for the West possible.

I am glad Mr. Ball referred to that problem.

Mr. BALL. I would like to say that the Senator made a much better statement off the cuff than I did in my prepared one regarding the situation.

Senator ANDERSON. I do not believe that. I want you to know it is something that has been very close to my heart and the hearts of many of the other western Senators. I am sorry that Senator Kerr is not here because he very generously permitted us to put what is known as a rider on one of his bills in order to make possible quickly this change in the interest rate situation in the upper Colorado States. The first State it is going to hit is the State of Colorado. So we are very glad that it is moving along in the right direction.

Now, Mr. Murphy, go ahead.

STATEMENT OF JOHN PATRICK MURPHY, EXECUTIVE SECRETARY, MIDDLE RIO GRANDE FLOOD CONTROL ASSOCIATION

Mr. MURPHY. Mr. Chairman and members of the committee, my name is John Patrick Murphy, and I am executive secretary of the Middle Rio Grande Flood Control Association. I appreciate the opportunity to appear here today, and, on behalf of the 500,000 people in the Middle Rio Grande Valley whom this association represents, I want to say that we are grateful to this committee for scheduling New Mexico as one of the States in which to hold these important hearings.

The story of water is the story of the human, agricultural, and industrial development of New Mexico. The places people live, their method of making a living, the type of communities they have built were dependent on water. Water will continue to be a dominant factor in the future development of our State. Certainly, the line which divides the rich land from the wasteland is a waterline unmistakable to the most casual observer. In certain areas of New Mexico, past civilization disappeared because it ran out of water. Today, almost every citizen of that area is aware that water is the key to its present and future economy.

Clearly a need exists for some criteria by which, in specific cases, the economic good of alternate beneficial uses of a fixed amount of water may be judged with reasonable accuracy. This is not to suggest that in all cases water should be diverted to its highest economic use, but rather that some better means of evaluating the economic benefits resulting from putting water to any of several uses should be available to those who must establish public policy or plan the development of water resources. The need for economic criteria is especially acute in New Mexico as it considers the financial and engineering problems in formulating plans that will assure the maximum beneficial use of its share of the new, unappropriated water of the San Juan River.

Conservation is all things to all people. To the thoughtful man, it is the means of preserving and enhancing our national wealth. All persons, even the exploiter, probably agrees that a widespread intelligent awareness of conservation in all its aspects is a commendable goal. In New Mexico, we have finally come to realize that water is the irreducible basic resource. What is done with it is of paramount importance, and the nature of its use determines the extent of an expanding or a crippled economy. Therefore, the most important programs that affect the future of New Mexico are those that deal with the development, use, control, and conservation of water resources.

Most important among the immediate projects in which the Middle Rio Grande Valley are concerned, is the comprehensive plan for (1) flood control and major drainage, including channelization, sediment entrapment and reduction of water-logged areas; (2) rehabilitation of the Middle Rio Grande Conservancy District, and the salvage of water lost to nonbeneficial plants. This is a joint undertaking by the Corps of Engineers, Department of the Army; and the Bureau of Reclamation, Department of the Interior. This project when completed and placed in operation will solve for many years the problem

of sedimentation that is causing aggradation of the river bed, overcome the ever-present flood threat to the valley, and salvage much of the water now being lost. The conservative estimates by the Army engineers on the flood control benefits of this phase of the project were placed at $4,800,000 annually.

Since the foregoing was authorized in 1948, additional flood problems have been brought to the attention of Congress. The cities of Socorro, Albuquerque, Belen, and Las Cruces all have similar problems in that each is situated on the banks of the Rio Grande directly in the path of tributary arroyos which rise on the steep slopes of nearby mountains. Severe flooding has been experienced frequently in these urban centers as a result of flash floods on intermittent tributary streams. In recognition of the serious nature of these problems Congress authorized review investigations in each locality and subsequently authorized construction of the Albuquerque diversion channels and Socorro flood control project.

A review of previous investigations for flood control on Rio Grande and tributaries in New Mexico in consideration of present economic development also has been authorized. This later review pertains to the need for a dam on the main stem of the Rio Grande above Albuquerque.

Since the original studies were conducted, there has been an unprecedented development in the flood plain of the Middle Valley especially at Albuquerque and vicinity. The population of Albuquerque has increased from 35,449 in 1940 to over 210,000 in 1959 and the principal business and industrial districts as well as a large segment of the residential district are subject to damage from major floods on the Rio Grande.

In recognition of this change in economic conditions, the U.S. Senate Committee on Public Works adopted a resolution on June 28, 1956, requesting a review of House Document 243 for the purpose of determining whether any additions or modifications should be made in the recommendations contained in that document.

During this review on the main stem of the Rio Grande, it has become even more evident that reservoir control of the main stem is essential for adequate protection of property in the middle valley and that because of the concentration of property at Albuquerque and vicinity the reservoir should be located as near to Albuquerque as practicable. In view of these findings, a plan has been developed by the Corps of Engineers which includes a reservoir in the vicinity of Cochiti to control spring and summer floods on the Rio Grande and a reservoir on Galisteo Creek near its mouth to control summer flash floods from the tributary watershed.

These two reservoirs—Cochiti and Galisteo—together with the completed Jemez Canyon Reservoir, Abiquiu Reservoir, which is under construction, an improved floodway, the completed Platoro Reservoir on the Conejos River in Colorado, and the authorized Wagon Wheel Gap Reservoir on the Rio Grande in Colorado would provide a high degree of protection from the Rio Grande in the Espanola and Middle Valleys. In fact, there would be no danger at all from floods similar in magnitude to those of historical record. This is merely a review study and has not as yet been authorized by the Congress for construction.

In addition to this review study, we asked Congress for further programing of our comprehensive plan. We are all agreed that if this is truly to be a master plan for flood control and water conservation in the Middle Rio Grande Basin, the Corps of Engineers must still do certain things and conduct further study and research. For instance, we urgently need something in the way of a silt-control dam on the Rio Puerco; some type of permanent treatment on the Rio Salado, Tonque, and other large creeks and arroyos; and protection from flash floods in the Socorro, Belen, Los Lunas area. We have been assured that these problems will be investigated and reported to Congress as soon as practicable.

Project work accomplished by the Bureau of Reclamation thus far are 400 miles of drains have been cleaned, cleared of brush, deepened and provided adequate access roads, bridges and culverts. The drainage system has been modified as appropriate to provide for optimum salvage of drainage flows for irrigation use. It is considered that the drainage construction is complete.

The work at El Vado Dam consisted of a new trashrack structure, cleaning and painting of the steel face, overhauling the gates and machinery, and grouting the foundations.

The four diversion dams of the project have been repaired and some of the structures modified to reduce the amount of sediment entering the canals.

Approximately 100 miles of laterals have been rehabilitated. This work consists of replacing wooden structures with concrete structures and cleaning and enlarging the laterals and building access roads.

The channel rectification work completed or under contract at the end of fiscal year 1958 includes the following major items:

1. Eighty-two miles of channelization through the San Marcial, Socorro, and Bernardo areas. This work consists essentially of a low-flow channel of 2,000 cubic feet per second capacity, which will handle the riverflows 85 percent of the time; a spoil bank levee on the east side of the channel, protected by a brush fringe and/or steel jetty installations; and a cleared floodway ranging in capacity from 25,000 to 60,000 cubic feet per second to handle floodflows.

2. Through the Expanola area 20 miles of major channelization consisting of a cleared floodway 400 feet wide, pilot channels and river cutoffs to straighten the river and to minimize erosion of agricultural lands.

3. Twenty-one miles of minor water-salvage channels in the San Antonio, Escondida, and La Joya areas, which are designed to minimize overflow of large areas of native vegetation and to lower the water table through the areas.

4. Four miles of a prototype channel in the Belen area to test the effectiveness of the proposed installation for an approximate 100-mile reach of river in the Rio Puerco Cochiti unit. This installation consists essentially of a cleared floodway approximately 600 feet wide defined by means of steel jetties on the river bends and straight-of-ways where there is insufficient brush fringe. The cost of the channel rectification accomplished to date is about $9 million or about 66 percent of the total channel-rectification program.

Following is a summary of the water salvaged through 1958 by constructed channelization works:

San Marcial conveyance channel, 305,000 acre-feet; Bernardo channelization, 12,000 acre-feet; and Escondida, San Antonio, and La Joya levees and drains, 6,000 acre-feet; making an estimated water salvage from 1954 through 1958 of 323,000 acre-feet, according to the U.S. Geological Survey. This water is estimated to have a value of $35 per acre-feet, or a total value of about $11,305,000.

Furthermore, it is considered that extensive additional opportunities for water salvage remain. Development of plans for achieving such salvage will require detailed analysis of the potentialities by reaches and the costs of potential salvage works. The Bureau has under consideration an expanded investigation program for this purpose. The contemplated program will include necessary supplemental streams gages, collection of ground-water data, vegetative density surveys and hydrologic analyses, together with related engineering and economic studies. The State of New Mexico participates generously and vigorously in this program, both financially and actively.

This water-salvage program has proven so successful, that eventually we expect to pay off our debt to the lower valley and restore New Mexico to a credit status under the terms of the Rio Grande compact. And this will mean that the Middle Rio Grande Conservancy District will again regain the use of storage space in El Vado Reservoir. At present they are faced with an impossible situation of trying to operate an irrigation district in a semiarid valley with infrequent riverflow and occasional rainfall.

Summarizing the reclamation benefits: The improvements to the Middle Rio Grande project works will lead to increased crop production of about $1,948,000 annually. In addition to these direct benefits, indirect benefits of $637,000 and public benefits of $204,000 annually will result. The total annual benefits attributable to this work are $2,789,000. Most of the benefits are directly attributable to restoration of an adequate water supply through elimination of the debit under the compact and inproved drainage for agricultural lands.

The Senate approved S. 72, 86th Congress, which would authorize the San Juan-Chama initial stage and the Navajo Indian irrigation projects; but, due to pressure by southern California and other unfavorable interests, hearings on this legislation have not been set by the House. This delay is unwarranted and we hope that justice will prevail in the second session.

The San Juan-Chama project is designed for ultimate diversion of some 235,000 acre-feet of water a year from the San Juan River in Colorado the the Rio Grande in New Mexico—the water crossing the Continental Divide by gravity flow. The plan includes a 400,000-acre-foot reservoir on Willow Creek; 48 miles of conduit—40 miles of which are closed or tunneled; and four irrigation units on tributaries of the Rio Grande in northern New Mexico, each with limited storage. These tributary units involve a total of about 39,000 acres, and they will actually receive their water by exchange. That is, the projects will divert Rio Grande water which will be replaced for downstream users by water imported from the San Juan River.

The initial stage development of the San Juan-Chama project, approved by State and Federal agencies concerned, and in collaboration with the Middle Rio Grande Flood Control Association, will divert an average of about 110,000 acre-feet of water annually.

According to preliminary allocations, about 57,000 acre-feet of the initial-stage diversion would be used annually for municipal and industrial purposes in the Albuquerque vicinity, about 23,000 acre-feet yearly would be used to supply supplemental irrigation water to the Middle Rio Grande Conservancy District, and about 30,000 would be released downstream to replace water diverted to the northern tributary exchange projects near Cerro, Taos, Llano and Pojoaque.

Construction of the tributary units will do much to revitalize the depressed economy of northern New Mexico, through the Espanola-Taos areas. The construction expenditures alone, amounting to about $22 million, will give that area an immediate financial boost, and the resulting stabilization of the area's economy should confer permanent benefits, providing at least some of the people with a decent living standard and reducing the welfare rolls in that severely-depressed section of New Mexico. Bureau of Reclamation cost-benefits studies indicate that, over a 100-year period, annual repayment expenditures for construction and operation and maintenance of all four projects will aggregate $121,700,000 while direct benefits to water users will total $136,400,000. Nor does the favorable balance of $15 million include indirect benefits that will result—such as the provision of recreation facilities, improved business condition, broadened tax bases, and so forth.

A deserving and long-neglected segment of New Mexico's citizenry—the Navajo Nation, largest single Indian tribe in the United States—will have an opportunity to become at least partially self-sufficient.

Some 15 years ago, the Navajo Nation numbered about 45,000 persons. Today, its population exceeds 90,000 and its per capita income is about $500 a year—probably the lowest of any ethnic group in the United States. Statistical information indicates that by 1980 the Navajo will number 170,000 and by the year 2000 their population will approximate 300,000.

Provision of water for expanded irrigation will greatly improve the agricultural economy of both the San Juan and Rio Grande Valleys, for Indian and non-Indian alike. But, in both areas the big promise for the future lies in industrial expansion.

What with its abundant water supply and its vast reserves of uranium, oil, natural gas, and coal, northwestern New Mexico is one of the most richly endowed areas in the Nation, and development of its great natural wealth is only now beginning. It is, truly a "Land of Promise", and the key to all development is water—water which construction of the Navajo Dam will make available by 1963.

Already, with a firm supply of water for industrial expansion guaranteed by the Navajo Dam, the Utah Construction Co. has entered a lease contract with the Navajo Nation to mine coal on the reservation for use in production of steam-generated electric power. To the area's abundant water resources and vast reserves of easily marketable mineral wealth, add a firm, and abundant supply of electrical energy, and a large pool of readily available local labor, and you have all the requisites for a dynamic and prosperous industrial economy. And industry in general is beginning to recognize that the labor force is available locally.

Just to keep things in focus, let's return now to the Rio Grande Valley.

For many years water has been in short supply in the Rio Grande Valley in New Mexico, and the shortage is becoming critical. Stated in round arithmetical terms, the valley possesses more than one half of the State's population and less than one-third of its known supply of available water. Population is increasing rapidly, municipal and industrial requirements for water are skyrocketing, and the known supplies that are available for beneficial use are fully appropriated. In fact, they are overappropriated.

What with its mushrooming metropolitan area, its nationally important military installations and defense industries, its world-renowned centers of scientific research and development, its colleges and universities, its ever-increasing force of civil servants (at the Federal, State, county and city levels), its rich agricultural developments, and its myriad "service" industries and enterprises, the Rio Grande Valley promises to continue as the center of New Mexico's growing population and industrial activity throughout the foreseeable future. The valley's human resources provide the foundation of its present prosperous economy and its vast potential for continued economic growth, and the water needs of this population must be served—preferably without cannibalizing its great agricultural enterprises which also are necessary to support continued urban-industrial growth.

The orderly development of water resources is of major significance to urban areas, particularly to those located in the arid Rio Grande Valley. Albuquerque's chief source of water supply is the underground reservoir of the Rio Grande depression. In recent years the city has developed this source to a high degree in order to meet the increased water needs of Albuquerque's rapidly expanding population. Slowly dropping water tables in the area, however, indicate that the underground water supply is definitely limited. The continued growth and prosperity of Albuquerque and central New Mexico is dependent on the development of water resources to supplement those of the underground basin.

The citizens of Albuquerque feel that the San Juan-Chama project is the most feasible method of supplementing its water supply, but development of this source is contingent on decision by the Federal Government. So, to stress the importance of this water requirement, let's examine the following material worked up for this report by the Albuquerque Water Department:

The year 1956 has been selected as the base year on which estimates of future water consumption are projected. Population served by water systems of the Albuquerque standard metropolitan area in 1956 was estimated by the city planning department to be 210,000 people. These persons utilized 56,100 acre-feet of water for nonagricultural purposes—or an average per capita consumption of 195 gallons per day. This figure includes industrial, commercial, and public uses of water. The capacity of the present city water system is 69.4 million gallons per day. Additions to the system which will be completed during the summer of 1959 will add 29.4 million gallons per day to the plant's capacity, for a total capacity this year of 98.8 million gallons per day.

Future water needs are contingent on the size of the population to be served (domestic, commercial, industrial, and public users) and the consumptive pattern of the population. Estimates of future population, based on current growth trends and approximations of employment opportunities within the area in terms of basic and nonbasic employment, indicate that by 1975 the area will have between 475,000 and 562,000 persons. The curve of population growth is estimated to remain constant or perhaps to increase in steepness of slope during this period.

For cities in arid regions, the average annual rate of increase in per capita water use is 4 gallons per capita per day. This increase results from new developments in sanitary technology, new household appliances, air-conditioning, and refrigeration, and changes in water use habits. Albuquerque has been growing at a remarkably rapid rate. This rapid growth will result in a water demand for public uses, such as parks and recreation facilities, of 2.7 times the amount of water currently used for these purposes. The present trend of consumption for all purposes but agriculture in the Albuquerque area, shows an average annual rate of increase in per capita use of 4.15 gallons per day. If this rate is projected to 1975, the rate of water use will be 275 gallons per capita per day. The per capita water figures, when adjusted to the population estimate for 1975, indicate a demand for 147,000 to 172,000 acre-feet of water during that year. These figures are summarized as follows:

Estimated water use and population, Albuquerque standard metropolitan area, 1956–75

	1956	1975
Population	210,000	275,000–562,000
Water needs:		
Per capita (gallons per day)	195	275
Total demand (acre-feet)	56,000	146,000–172,000

Based on these figures, the 1975 average daily demand will be 131 to 153 million gallons of water. It must be remembered, however, that these are average daily figures. During the peak consumption periods of midsummer, water consumption in Albuquerque is double the annual daily average. Using the maximum estimated population for 1975, peak daily water consumption will be 306 million gallons. This is more than three times greater than the capacity of the system after completion of improvements under construction.

EMPLOYMENT AND INCOME ANALYSIS

Albuquerque's economy is heavily dependent on Government expenditure. In 1956, 22,050 of 71,050 employed persons in the Albuquerque standard metropolitan area were employed by units of Government. Of these, 16,675 were employed by the U.S. Government. Income from Government employment accounted for 23.4 percent of all income payments in 1956.

In addition to the direct Government employment mentioned above, Government expenditures for defense purposes contributed indirectly to other employment, principally manufacturing, in the Albuquerque area. Direct and indirect Government employment accounted for 33.1 percent of all employment in 1956. When basic employment is considered, the percentage is higher. (Basic employment is concerned with goods, services, and capital for export to consumers outside the Albuquerque standard metropolitan area.) The National Government alone contributed directly and indirectly 60 percent of basic employment. Direct and indirect income payments by governmental agencies yielded 51.6 percent of total income payments (33.8 percent direct and 18 percent indirect).

Federal employment has important implications upon water consumption in the Albuquerque area. If the total number of persons employed in 1956 is divided into total population of the Albuquerque area, the resulting ratio is one employee to each 2.96 of the total population. By applying this ratio to the number of National Government employees it can be estimated that direct and indirect National Government payroll expenditures provided support for approximately 126,000 persons in 1950. These 126,000 persons used approximately 27,740 acre-feet of water—or 49 percent of the total water used in the Albuquerque standard metropolitan area.

NATIONAL DEFENSE REQUIREMENTS

The Rio Grande Valley in New Mexico has three major areas where the impact of national defense operations on the economy is significant. These are the atomic energy laboratories at Los Alamos; the combined Kirtland Field-Sandia Base installations at Albuquerque; and the Holloman Air Force Base-White Sands Missile Range near Alamogordo and Las Cruces.

Their water problems are definitely interrelated with those of the Rio Grande underground water basin, and thus are a part of the complex pattern of develop-

ment that has occurred throughout the valley, which is one of the most vital areas in the national defense programs.

Long before the establishment of the national defense installations the surface waters of the Rio Grande were recognized as being fully appropriated. Since the Rio Grande compact was ratified in 1938, essentially every new application to appropriate waters from this stream has been protested and denied.

The defense installations have contributed their share to the water supply problems of the basin. Los Alamos, completely a defense installation, is a town of more than 13,000 people. On the basis of estimates developed in the San Juan-Chama project studies, its annual use of water is in excess of 2,000 acre-feet. Estimates developed by the Albuquerque Planning Department's staff, indicate that some 21,900 acre-feet of water annually are used in the Albuquerque area by people directly or indirectly involved in national defense activities. Similarly, at Las Cruces the water used by the increased population brought in by defense activities is estimated to be at least 2,000 acre-feet annually. Coming from a fully appropriated stream, this amount of water consumption is significant and, in itself, is an adequate basis for Albuquerque to plead its cause.

The future needs of these defense installations are even more important. Without referring to any specific plans, we can point out that all such installations normally can expect a reasonable rate of growth and a reasonable increase in water needs. At the same time, it is only prudent to prepare for unforeseen requirements, some of which might be quite large.

The initial stage of the San Juan-Chama project proposes to divert an average of 110,000 acre-feet of water from the headwaters of the San Juan River into the Rio Grande Basin. This water would be regulated in a reservoir with the capacity of 400,000 acre-feet on Willow Creek, just above El Vado Reservoir, and would be released as needed downstream.

It is anticipated that there will always be a supply of water in this reservoir, and that there will be recreational features developed, such as boating, fishing, swimming, picnicking, camping, overnight accommodations, and concessionary facilities. It has already been proven, that such added recreational attractions would produce very large benefits to the State and to the immediate area surrounding the reservoir.

Because of the significant tourist appeal of the area between Albuquerque and the Colorado-New Mexico State line, especially during the summer months, the recreational importance of this permanent pool reservoir on Willow Creek would be very large. This would also be true of a permanent pool in Cochiti Reservoir, just above Albuquerque, and definitely a tremendous asset in the Navajo Reservoir in the Farmington area.

I wish to point out and emphasize that traditionally, throughout the West, beneficial use is the basis, the measure, and the limit of the right to use of water, and there are few if any areas in the Nation where water can be used more beneficially or more advantageously in the coming decades than in the San Juan and Rio Grande Valleys in New Mexico. The State itself has resolved its differences of opinion with reference to where and how this new unappropriated water shall be used. Thus, we support in its entirety the statement filed by S. E. Reynolds, State engineer, concerning the future planning and water resources problems of the State of New Mexico.

Multiple-purpose projects such as the San Juan-Chama project for municipal, industrial, and irrigation water, are not matters to be put off pending a recession or depression. On the contrary, such projects should be constructed as rapidly as possible so as to contribute toward continued prosperity and a high standard of living. New Mexico, in fact, needs this project now to preserve its land and water resources.

New Mexico's economic health and growth are wholly dependent on water. Our usable water supplies, always a grave concern, are today critically short and failing further every day. Droughts always have hit New Mexico hard. They have made our economy "sick" too often, too long. Our people are paying an enormous price for the delay in the apportionment of the use of the waters of the Upper Colorado River and its tributaries.

For years and years that much-needed water has been flowing right out of our State. New Mexico is deriving no benefit from it. It is imperative that this waste be stopped as soon as is humanly possible.

Utilization of these now-unused waters of the San Juan—of transcendant importance to the Middle Rio Grande Valley—has been envisioned for over 20 years.

The solution of these water problems is one of the most pressing needs of the State of New Mexico. The only hope for maintaining the existing economy and providing for a normal, continued growth in these areas is to import additional waters. The San Juan River is the only source available. It truly is our last waterhole.

From here on, New Mexico's future growth will be limited only by its water supply; therefore, it is imperative for us to develop this new water to its optimum, beneficial use, and to conserve every drop of this precious resource.

I would like to point out that in a report rendered December 11, 1950, by the President's Water Resources Policy Commission, they stated that "the Rio Grande Basin was a sick area" and thus "importation of water from other basins was essential." In the recommendation of importation of water they were referring to the San Juan River waters recently allocated to New Mexico by the Upper Colorado River compact.

As our State engineer has testified:

> Early development of the water resources of the San Juan River is essential if the growing water needs of the State are to be met. The coordinated report on the San Juan-Chama and Navajo projects was transmitted to the Bureau of the Budget in September 1957, but that Bureau has not yet transmitted its recommendation on these reports to the Congress. The U.S. Senate has approved S. 72, 86th Congress (Senators Anderson and Chavez), which would authorize the Navajo irrigation project and the initial stage of the San Juan-Chama project, but House hearings on this legislation has not been set.

Therefore, if it is within the functions and/or scope of the activities of this Senate Select Committee on National Water Resources to assist us in expediting authorization of our Navajo Indian irrigation project and the intial stage of the San Juan-Chama project as participating projects of the Colorado River storage project, we, the people of New Mexico will be deeply grateful.

I appreciate very much this opportunity to appear before your committee, and on behalf of the Middle Rio Grande Flood Control Association and the 500,000 persons whom we represent, I wish to say—thank you.

You have heard the reports of the State engineer and the various departments and mine merely highlights the things that we need desperately in the Rio Grande Valley which begins at Elephant Butte and goes north to the Colorado line. We have a witness here who I would like to have heard. He represents the people from Espanola through Cerro. He is Phil Maestas.

Senator ANDERSON. We thank you very much, Mr. Murphy.

Come ahead, Phil. You strangers ought to know this is one of the stalwart champions and longtime fighters for reclamation in New Mexico. We had a meeting one time in Washington that we had to adjourn because it was not legal without Phil being there.

You go ahead.

STATEMENTS OF ANGUS EVANS, PHIL MAESTAS, AND C. H. YATES, REPRESENTING THE ESPANOLA VALLEY

Mr. MAESTAS. Senator Anderson, first of all, the Espanola Valley appreciates the fact we are invited to this hearing.

Honorable members of the U.S. Senate, we are here to present the needs for supplemental waters for the Espanola Valley, the people of Taos County, and all those that would benefit by the San Juan-Chama diversion project.

We are informed that under the terms of the Upper Colorado River compact, New Mexico is entitled to about 800,000 acre-feet of water from the San Juan River, the bulk of which at present flows into the Gulf of California.

When New Mexico became a State back in 1912, under act XVI, section 1 of our Constitution, all existing water rights at that time were confirmed and recognized.

Under act XVI, section 2, all unappropriated waters belong to the public.

It is now conceded that there are practically no unappropriated surface waters left in the State of New Mexico, so the only solution remaining is to utilize the waters to which we are entitled under the terms of the Upper Colorado River compact which was ratified by New Mexico in 1949.

In order that our section of the State can benefit from the said compact, the construction of the San Juan-Chama project becomes a must if our valley is to continue to grow and improve our economy.

It is estimated that our valley, out of the 110,000 acre-feet to be diverted from the upper reaches of the San Juan River, will be allocated, about 29,900 acre-feet are to be distributed as follows:

	Acre-feet
Cerro in Taos County	9,900
Taos	12,000
Espanola and vicinity	6,700
Pojoaque	900

The areas east and northeast of Espanola where preliminary surveys have been made, consist of about 1,900 acres of San Juan Pueblo Indian land, lying east of Highway 64, and about 2,620 acres of the lower end of the Santa Cruz Irrigation District.

As concrete evidence that we need supplemental water as of today we are indebted to the State of Texas under the terms of the Middle Rio Grande compact, in the sum of 468,000 acre-feet of water, enough to take care of the Santa Cruz Irrigation District for a period of 31 years.

We respectfully urge the San Juan-Chama project.

Thank you.

Senator ANDERSON. We ought to all be encouraged by the fact that we paid a little of our debt to Texas by a couple of good flows in

the stream during the past few years and by the saving of water that has already been accomplished.

I am glad you mentioned that date because it adds point to the comment made earlier that we need to save all the water we can along the river and get rid of all plants causing difficulties and pray for the Lord to give us a little extra water once in a while in rain.

Mr. MAESTAS. I want you to know we are happy that that bill has been passed in the Senate several times.

Senator ANDERSON. Before closing this record on the hearings in Albuquerque, N. Mex., of the Senate Select Committee on Water Resources, I have with me some statements that I would like to put into the record.

First is the statement of the New Mexico Association of Soil Conservation Districts, which has been submitted through J. Lewis Merritt, its president.

I would like permission to put that into the record.

(The statement referred to follows:)

STATEMENT OF J. LEWIS MERRITT, PRESIDENT, NEW MEXICO ASSOCIATION OF SOIL CONSERVATION DISTRICTS

Mr. Chairman and members of the Senate Select Committee on National Water Resources, New Mexico soil conservation districts are vitally concerned with soil and water conservation problems. It is indeed gratifying to know that our National Government is making an intensive study of the total water resources in the United States. We are pleased that the committee recognizes that New Mexico has water problems and has elected to conduct a public hearing in our fair State.

We earnestly request that the committee consider the role of soil conservation districts in the total program of developing, conserving, and making wise use of our meager water supply. More than 50 percent of the farmers and ranchers in our State are cooperating with soil conservation districts by applying soil and water conservation measures to the land. It is important that we recognize that any program of water resource development must begin on the land. To be effective the program must have the cooperation of the owners and operators of our range, crop, and forest lands. For in the final analysis, it is what they do on the individual farm and ranch that will contribute most to the development, conservation, and wise use of our water resources.

As president of New Mexico Association of Soil Conservation Districts, my comments will pertain more to problems of water use that have been called to my attention during my tenure. There is little need for me to review programs of Federal agencies that are presently helping us find solutions to our water problems except in terms of problems that have been called to my attention.

We are all concerned with a fair and equitable distribution of water resources among all sectors of the State's economy, and among all users of the State's water resources. A maximum degree of coordination and planning for water use is necessary to assure the most efficient use of the State's water resources. The solution of the problem of achieving proper balance among the users of the State's water will require teamwork among those in professional and scientific fields who contribute to our knowledge concerning the nature, occurrence, control, and utilization of water. Another factor essential to efficient water use is coordination among the many agencies who plan, construct, and operate water development projects. The achievement of coordinated teamwork requires interchange of information and mutual understanding among the various organizations concerned in New Mexico water resource problems. It is hoped that this coordination and understanding can be attained by the study this committee is making and by the opportunity for all of us to contribute to the State's report to the Senate Select Committee on the Nation's Water Resources.

Soil conservation districts are actively suporting the Watershed Protection and Flood Prevention Act, (Public Law 566, 83d Cong.). We have found a problem in applying this law to New Mexico conditions. One objective of the various laws for flood control and watershed protection is to permit work of

this nature to begin on the upper reaches of the watershed. The floods are then controlled closer to the point of their origin. Existing laws afford the opportunity to create intersupporting projects. Public Law 566 is designed for flood prevention on the upper reaches of the streams. In New Mexico, these occur at the higher elevations. The value of any farmland at these higher elevations is limited, in that the range of crops that can be grown is small, and by the short growing season. The general patern of irrigated cropping in one of our valleys begins with flood irrigated native grass at the higher elevation and, through stages, reaches intensively farmed cotton farmland at lower elevations. Although the value of these intensively farmed areas is enhanced by the work on the upper watershed, the number of watersheds that have potential for construction under this law is limited by the lower value of the farmland at higher elevations. The limited number of potential watershed projects is a factor of the size limitation of watersheds as well as to the means of computing damages. Thus, we suggest reevaluation of the justification for watershed protection and flood prevention work in New Mexico, with the possibility of creating a wider range of participation. The benefits of an expanded program would be far reaching.

We would like to suggest that the possibility of providing a more uniform water supply to the old irrigated areas among the foothills along the east slope of the mountains be thoroughly investigated. These irrigated areas have been marginal since their inception although they have had periods of adequate water and good crop production. New Mexico has a relatively small amount of unappropriated water. The possibility of diverting San Juan and/or Rio Grande water to these regions should be thoroughly explored. We should concentrate on increasing productivity on already existing irrigated farmland prior to development of more irrigated land.

Because of topography and climate, New Mexico is a land of recurring droughts and flash floods. The pattern of rainfall in New Mexico results in many flash floods and rapid runoff. A large percentage of this water ends its journey in our many "playa" lakes. A small percentage of this water reaches our underground basins. It is our opinion that we should conduct more research on the possibilities of recharging the floodwater into the underground basins at relatively high elevations. This will permit maximum benefit from underground recharge. These projects should be accomplished with minimum conflict of existing water rights.

Many of our rural areas would benefit greatly from more uniform water supplies for both agriculture and industry. Many of our people must turn to industry for a livelihood. Structures which will regulate our State's waters and create more uniform flows will be of great benefit in the development of our rural areas, as well as provide more adequate water supplies for the municipalities of the State.

Other programs of interest to the soil conservation districts of New Mexico, and that we feel merit study, are:

Desalinization of ocean water: If desalinization can be accomplished at a low cost, more of this water could be used to fulfill the needs of the coastal States. This would permit a higher percent of the water originating from this State to be used by the citizens of this State.

Saline underground water: The possibility of using saline underground water in New Mexico should be investigated. Perhaps processes for desalinization may be developed which will permit this water to be used for industrial purposes as well as for irrigation and by municipalities.

Phreatophyte control: We encourage continued studies on the control of phreatophytes. Many of our streams are still lined with salt cedar, cottonwood, willows, and other plants which use much of our State's waters.

Climate control: Continued study on climate control is encouraged.

Atomic power applicability: The possibility of using atomic power on water resource problems should be encouraged. Cheaper atomic power sources could be used in pumping water and in desalinization processes.

Our soil conservation districts have emphasized efficient water distribution and use from main canals to irrigated fields. We will continue to emphasize this essential conservation measure, but we need help in our educational program to put research and technical knowledge to practical use on our irrigated farmlands.

Last, but in no means least, we request that you consider the findings reported in Senate Document No. 59 of the 86th Congress, 1st session. This docu-

ment outlines major soil and water research needs of the Nation. Water conservation and management research is badly needed in New Mexico.

Many organizations have already contributed to the solutions of the problems outlined above. A continuation of the very fine efforts of all organizations concerned will do much to assure the future of New Mexico agriculture. Coordination of efforts and a clearly defined responsibility for each will assure this continuation. Any national water policy should be flexible and periodically adjusted to the changing needs of the Nation. Any national water policy should be adjustable to the needs and character of any geographic area or specific conditions in an individual State.

Senator ANDERSON. I want to say this has been an interesting meeting. We have a feeling that out of these hearings will come an improvement in our water policy and a unified effort to develop tremendous interest in the whole problem that has arisen because of the need for water.

I think that I could say to the people who represented the conservation groups that the testimony in Colorado was of great interest and the fact that people pointed out that the recreation business in areas of Colorado served by water was of more value to them than some of the crops previously grown with the same water on the part of the land. It tends to call our attention to the fact that we are looking for high and valuable uses of this water and do not want it wasted in any fashion whatsoever, but want to make the very greatest possible use of it for the benefit of our western people.

In behalf of Senator Kerr and the members of his committee, I thank all who participated today, particularly in the fact that they cooperated in time to permit this staff to get through the hearing at a reasonable hour in order that they may go to Salt Lake City for another important meeting there. Thank you very much for being here.

(Whereupon, the committee recessed at 1 p.m. Monday, November 23, 1959.)

(Subsequent to the closing of the hearing, the following statements were received:)

STATEMENT OF W. A. WILLIAMS, JR., CHAIRMAN, NEW MEXICO STATE SOIL CONSERVATION COMMITTEE

Mr. Chairman and members of the Senate Select Committee on National Water Resources, we wish to concur in the testimony presented here by the New Mexico Association of Soil Conservation Districts. In addition, we wish to bring to the attention of this committee the results of the continuing conservation needs inventory which shows New Mexico today is in need of additional water, and is experiencing a phenomenal population growth now and in the projected future.

We would like to emphasize the major portion of usable water in New Mexico falls on and is produced from Federal lands. The management and control of these lands "will make or break" the future of this State. It is the obligation of the Federal Government to manage, conserve, and develop the natural resources of these lands to produce the maximum usable water. The policy of limited use as proposed in "Wilderness Legislation" is not the way to get this done. The multiple-use principle as practiced and proposed by Federal land administering agencies will produce more water, more game, more recreation, and more income by the orderly harvesting of natural resources.

The principal of watershed-protection and flood-prevention work being accomplished by Public Law 566 is the proper approach to upstream protection, silt control, and water development; however, Public Law 566 projects in the public-land States fall far short of being the entire answer, as the cost-benefit criteria under which they are approved disallows doing the entire job. The better projects with which we are acquainted do only approximately 50 percent of the overall protection work. We propose the use of surplus Government

equipment (bulldozers, carryalls, trucks, etc.) operated and maintained by surplus human resources (trustee prisoners or juvenile offenders). The conservation and development work accomplished by this proposal would be strictly to supplement "going programs" of Federal agencies, including Public Law 566 projects. This assistance should be channeled through soil-conservation districts, as they have the authority and trust necessary to coordinate the conservation and development works which will involve numerous Federal, State, and local agencies and organizations. The work accomplished on public lands or work of public benefit should complete the flood-prevention protection and do works of improvement, such as water development, access roads, recreation and game habitat development and aid in the rehabilitation of human offenders with very little additional cost involved.

The New Mexico State Soil Conservation Committee supports the U.S. Department of Agriculture's program for the national forest; the Department of Interior's 20-year program of conservation and development; and corrective legislation which will allow New Mexico to do conservation and development works on the State lands. We urge you to support legislation which will protect individual and State's water rights. We question the expenditure of large amounts of public funds to construct large, short-lived dams for silt detention. We believe that conservation work and small detention dams established in the upper and tributary watersheds will do a more complete job with lasting benefits for the people at less expense.

We strongly urge the Congress of United States to approve and authorize the construction of the San Juan-Chama transmountain diversion project now pending, as a portion of the Upper Colorado River projects.

STATEMENT BY CLARENCE L. FORSLING, ALBUQUERQUE, N. MEX.

THE LOWER WATERSHED—A MAJOR WATER-RELATED PROBLEM IN NEW MEXICO

My name is Clarence L. Forsling. I live in Albuquerque, N. Mex. I am now retired. I formerly was engaged for a good many years in watershed research in the Forest Service. For 7 years I was Chief of Research in that agency. For 2 years I was Chief of the Grazing Service in the Department of Interior in charge of administration of the public domain under the Taylor Grazing Act. Subsequently, I was chairman of the Southwest Field Committee of the Department of Interior, which coordinated all of the land, water, and other activities of the Department in New Mexico and in parts or all of six other States in the Southwest. Until recently I was associated with the Charles Lathrop Pack Forestry Foundation in its program in watershed conservation in the Southwest.

Excessive erosion and sedimentation are indirectly the causes of great losses of water supply in New Mexico and present a major problem in need of solution. The purpose of this statement is to point out briefly how this problem arises and to outline a neglected essential part of the solution.

Waters of the Rio Grande and the San Juan River and their tributaries generally are clear where they enter New Mexico from Colorado. Also, the streams which rise in New Mexico's high mountain watersheds are generally clear where they debouch into the valleys. But within a relatively short distance after they enter the State or leave their mountain canyons these streams begin to pick up silt and, especially during the high-water season, soon flow heavily laden until they enter storage reservoirs. The point is that the upper watersheds, which for the most part are in the national forests, yield most of the water supply but produce relatively little sediment. On the other hand, the lower watersheds, which furnish relatively little water, yield most of the sediment.

The mere deposition of this sediment in the stream channels, or on the flood plains, and farmlands which border the streams and in water-storage reservoirs, of itself, doubtless could be tolerated for a good many years to come, although eventually it would lead to the destruction of reservoirs and other values, as has already been done in a number of cases. But of greater immediate as well as long time concern is that the sediment deposits are indirectly the cause of water loss that is becoming greater and greater year by year. The situation has been well described by New Mexico State engineer, S. E. Reynolds, as follows:

"One of the most serious water-resource problems facing New Mexico and other States of the West is the large, rapidly increasing depletion of water supply by nonbeneficial plant growth on and along the streams. This problem is related to sedimentation in that sediment deposits provide a favorable breeding ground for such plants. Water lost to such plants in New Mexico is variously estimated from 500,000 to more than 850,000 acre-feet per year. This problem is of such magnitude that Federal assistance in studying and carrying out corrective measures will probably be required to prevent disaster. Furthermore, local financing is generally impractical because the beneficiaries of most water-salvage programs are not readily identifiable. The water salvaged is used by numerous individuals as well as corporate diverters."

It might well be added that the water being lost to this nonbeneficial vegetation in New Mexico adversely affects the supply being relied upon by users in downstream States as well as in New Mexico. In other words, it is an interstate problem with which we are dealing.

To meet this problem requires a number of essential steps or parts. They include the channelization of the river valley as is now being initiated in the Middle Rio Grande Valley. It also requires controlling the spread and reducing the stand of phreatophytes, which is now in the research and experimental stages. Still another phase is the construction of sediment storage reservoirs as has been done in Jemez Creek, is being done in the Chama, has been proposed at Cochiti site on the main Rio Grande and on Gallisteo Creek, and should be considered for at least two more tributaries—the Rio Puerco and Rio Salado. But these works and especially sediment-storage reservoirs will only be temporary unless the further steps are taken of providing control measures on the lower watersheds where the sediment originates.

Generally, the plans being developed for flood and sediment storage by the Corps of Engineers provide for only about 50 years of sediment storage and reserve. The Corps of Engineers in its report on the Middle Rio Grande project (H. Doc. 243, 81st Cong., 1st sess.) states in part as follows:

"Although the construction of dams on the main streams will stop a large part of this sediment before it gets into the reach of the river where damage is now being done, it is more important that this sediment be held at its source. The solution of this problem is the accomplishment of an extensive watershed improvement program which will improve the vegetative cover, stabilize and improve the soil, and stop the further erosion of lands and formation of gullies."

The Bureau of Reclamation in commenting (in House Document 653, 81st Congress, 2d session, entitled a "Report and Findings on the Middle Rio Grande Project, New Mexico") on the sediment detention features of the proposed reservoirs, stated "a more intensified watershed improvement program also must be made effective, as otherwise the valley would again revert to its present conditions when the reservoirs have served their useful life. A major step looking toward the permanent solutions of the problem lies in the early improvement, stabilization, and continued maintenance of the watershed in order to prolong the useful life of the reservoirs and thus the life of the project."

The Department of Agriculture for a number of years prior to 1951 undertook an examination of the Rio Grande watershed as a basis for a plan that would set forth the need and justification for a watershed treatment program, together with its description and estimate of its costs and benefits. The report was never published.

The tragic and regrettable fact is that nothing of a comprehensive or coordinated nature is being done to control the erosion on the worst eroding lands of the Rio Grande or other watersheds in the State. Present efforts to control erosion and sediment are very spotty and entirely inadequate in extent.

Part of the solution of the problem of controlling sediment at its source (for example, controlling erosion) is to be found in the work now underway on a far too limited scale by the Bureau of Land Management on some of the public domain lands on the major river drainages. The work under Public Law 566 on private land and to some extent on public land, and also that under the soil conservation district program, will help in some degree, especially on the better lands. However, none of these programs on the lower watersheds, except the too limited work of the Bureau of Land Management, is adapted generally to meeting the problem on the low quality lands, regardless of whether they are in private or public ownership. We are speaking here of the naturally sparsely vegetated sloping lands with unstabilized soils such as the lower

slopes of many hills and mountains, the "breaks" between different levels of plains or mesas, the broken land between plains or mesas and the valley lands, and the "badlands" or near badlands which occur in several parts of the State. These are the heavy contributors of sediment.

It should be reiterated that these lands (exclusive of their minerals) are of very low value for grazing or any other commercial purpose. Very little of them have passed to private ownership except where they were included with other more productive lands in the old Spanish and Mexican land grants made prior to the time where what is now New Mexico became a possession of the United States, or in railroad land grants. Despite their very low value for grazing, they have never been segregated by fencing or otherwise from more productive flatter lands generally found on the adjoining mesas and plains. This is so irrespective of whether these lands are Federal, State, or privately owned. However, even though they produce very little forage, livestock are permitted to wander over them and graze the sparse vegetation and loosen the unstabilized soil by trampling. Probably the greatest damage is caused by trampling but, also, every bit of vegetation that grows on much of this land should be left to contribute its bit to holding the soil. Generally, these are lands which private owners cannot afford to improve or stabilize under Public Law 566 or any of the other conservation programs involving heavy private investment, chiefly because the onsite benefits are so low.

A further essential step is necessary, therefore, in the solution of the erosion and sedimentation problem which is contributing so greatly to loss of water supply in New Mexico. It is described as follows: In order to stop further deterioration and in order that the natural healing capacity as well as other soil and water conservation measures that are necessary to be undertaken may be fully effective, all grazing and other incompatible uses of the vulnerable lower watershed lands as described above must be rigidly controlled or eliminated as may be necessary; however, it need not prevent development of the mineral resources. This must apply to all lands whether now in private, State or Federal ownership. Public domain lands should be retained in place wherever they serve the purpose of the program. Public domain lands not needed in place for watershed protection or for other national public purpose should be used as a basis for acquiring the privately owned lands that are vulnerable to erosion and are needed as part of the watershed protection program. The private lands should be acquired by exchange for public domain lands that are not naturally highly vulnerable to erosion or by purchase with funds derived from the sale of any public domain lands not needed for public purposes. All State lands at present within the designated watershed protection areas should be retained by the State and utilized and managed in the same manner as the adjoining land so as in effect to constitute a State contribution to the program. A suitable program should be worked out also with the several Indian groups for dealing with the problem on Indian lands.

The first step in the program would consist of seeking out the watershed lands in the State which are in need of the control and treatment for stopping excessive erosion and sedimentation.

The second step would be to classify the public domain land to determine (1) the individual tracts which should be retained in place by the United States for the watershed protection or other essential public programs; (2) the tracts of public domain that are not needed in place for the watershed protection or other public programs and may be used as a basis for either exchange or purchase of privately owned lands needed in the program. Under the sale and purchase phase of the program, public lands would be sold and private lands acquired at prices based on their appraised values. Where necessary, the right of eminent domain should be exercised to acquire needed land. As rapidly as the areas needed for watershed protection have been determined and the acquisition of the privately owned land has been initiated, they should be designated as "watershed protection reservations" and placed under the custody of an existing competent Federal land management agency for management and treatment.

It should be borne in mind that for the most part the plan would remove from use only land of low productivity. Under New Mexico practice of assessing rangelands on a grazing capacity basis for ad valorem taxation purposes, it would eliminate very little of the tax base.

On the other hand, it would provide an essential part of meeting New Mexico's paramount problem, the conservation of the limited water supply. From time to time the suggestion is made that the public domain land in New Mexico be

turned over to the State. Fundamentally, these suggestions are based on the premise of increasing income to the beneficiary institution of the State; in other words, on exploitation. The need for conservation is wholly absent from these plans except for a small verbal gesture. Exploitation of these lands without control or conservation would greatly aggravate the present watershed situation. The greatest and best use that can be made of the public domain in New Mexico is to devote it first of all to watershed conservation to improve the State's water supply situation. In fact, such a devotion appears to be the last hope for a practical means of solving the watershed problem in the State.

NEW MEXICO DEPARTMENT OF STATE FORESTRY,
Santa Fe, December 9, 1959.

Re water resources.

Senator CLINTON P. ANDERSON,
U.S. Senate, Washington, D.C.

DEAR SENATOR ANDERSON: On November 23, I attended the hearing of the Senate Select Committee on Natural Water Resources at the U.S. courthouse in Albuquerque, N. Mex.

Although I did not prepare a paper for filing with the committee, I do recall that a paper was presented supporting a view that the best management of a watershed involved the removal of all trees thereon. This paper stuck in my mind for the reason that I had just returned from a foresters' convention in Vermont and had observed a project wherein a water forest was planted which increased the underground water supply for the village of Essex in that State.

I am enclosing herewith a report from the Department of Forests and Parks of the State of Vermont which gives the details concerning this project and which I wish you would file with the committee, along with this letter.

Very truly yours,

RAY L. BELL, *State Forester.*

STATE OF VERMONT,
DEPARTMENT OF FORESTS AND PARKS,
Montpelier, Vt.

ESSEX JUNCTION VILLAGE FOREST

The Essex Junction Village Forest was established in 1900 by the purchase of 752 acres of land on which there were several springs. Subsequent purchases have increased the area of the forest to over 800 acres.

At the time of the establishment of the water reservation the timber had been completely removed. The area is sandy, and as time went on the sand began to blow. Evidence of dunes which formed can still be seen on the area. The water system was not given much care and in 1923 there was a "water famine" in the village which then had a population of about 1,500 people. Beginning in this year trees were planted until all of the open land was planted. Difficulty was experienced in establishing trees on the dunes and several of these areas were replanted several times. The bulk of the planting was completed by 1938. Species planted include red pine, Scotch pine, white pine, and white cedar, the majority being red pine.

Many of the plantations have now reached a size where commercial thinnings are being made for pulpwood.

The population and daily water consumption taken from village records for selected years are shown below:

Year	Population	Gallons
1898	1,100	39,160
1932	1,600	56,985
1945	2,300	68,382
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The water available daily from the system at the time of acquisition was estimated at 155,000 gallons. Measured capacity of the system today is 300,000 gallons.

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STATEMENT BY PECOS RIVER COMMISSIONERS J. C. WILSON, FOR TEXAS, AND GEORGE L. REESE, FOR NEW MEXICO

The Pecos River, while compared with other rivers of the West, has most of the problems that confront any of the larger western streams. These problems consist of recurring destructive floodflows, recurring drought periods, poor quality of water, sedimentation, and last, but not least, large nonbeneficial uses of water by natural water-loving plants, such as salt cedar and salt grass.

The phreatophyte growth in certain reaches of the Pecos River in New Mexico and Texas is depriving man of water from an already limited supply which he otherwise could beneficially use. Of greatest import is the fact that the growth or spread of this phreatophyte infestation is becoming progressively more serious and their end result could cause abandonment of lands, which are now, or in the past have been irrigated.

Records indicate that prior to 1912 there were no salt cedars (*Tamarix pentandra*), the most aggressive of the phreatophytes, in the Pecos River Basin. In that year they began to come into the Pecos Basin as well as into other river basins in the southwest. In the year 1947 the area of salt cedar in the Pecos River Basin was about 27,000 acres. This year is significant because it is the conditions of 1947 around which the Pecos River compact was framed. One of the very first acts by the Pecos River commissioners after the compact was signed and ratified by the two States and Congress, was to have aerial pictures made of the basin and maps prepared from the aerial photographs to show the various types of cover on the irrigated area of the basin.

The area directly above Lake McMillan to the Artesia Road (New Mexico State Road 83), an approximate distance of 16 miles, showed a growth of phreatophytes and other water-loving plants of nearly 11,000 acres, and by 1955, when legislation was introduced into the Congress to construct a low-flow conveyance channel and cleared floodway through this delta area, the growth of salt cedar and other hydrophytes had increased to nearly 14,000 acres, consuming nearly 45,000 acre-feet of water annually. As near as can be estimated, the area of salt cedars and other plants that are consuming water nonbeneficially from Alamogordo Dam in New Mexico south to the Texas State line is approximately 43,700 acres, and in Texas from the Red Bluff Reservoir to Girvin there is an equivalent acreage. If the salt cedar growth in the Pecos River Basin is permitted to grow uncontrolled, it is estimated that the acreage will double itself in the next 50 years, and would consume practically all the flow of the Pecos River.

There has been an inadequate supply of water for established uses in the Pecos River Basin in New Mexico and Texas for a number of years. The supply has been gradually reduced by drought, salt contamination, and salt cedar infestation, and State and local interests are incapable of effectively combating the latter.

The economy of the Pecos Basin in New Mexico and Texas is based primarily on agriculture. The water shortage has not only adversely affected general business conditions in the area, but has also affected the ability of both the Carlsbad Irrigation District in New Mexico, and the Red Bluff Water Power Control District in Texas, to meet current obligations, or enter into repayment contracts for badly needed improvements and rehabilitation work.

We, the Pecos River commissioners, recognize that there will be an ever-increasing demand for water in the arid and semiarid regions of the Western United States, and that the conservation of the limited supply cannot be overemphasized. One way of conserving the limited supply is the elimination of nonbeneficial uses. The salt cedar or phreatophyte falls within this category. We know that the economic value of most phreatophytes is low and the water used by them is virtually wasted. Water dissipated in this manner has been referred to as nonbeneficial consumptive use and more recently, as consumptive waste. We appreciate the fact that the restoration of water to the river by eradicating the phreatophyte is relatively new and must be approached by all with caution, and that research is necessary to understand, analyze, and solve the eradication and control problem.

We feel that inasmuch as this problem is of major importance and affects so many western streams, that the eradication and control programs should be federally financed and supervised. We plan to request the next Congress to initiate a salt cedar eradication and control research program, and hope that

the Pecos River from Alamogordo Dam to Artesia in New Mexico, and from Red Bluff Dam to Girvin, in Texas, will be included in the initial programs.

It is expected that over 100,000 acre-feet of water annually may be restored to the river in New Mexico by an eradication program, and this water should help restore the economic structure of the middle Pecos River Basin. In the lower basin in Texas there is a potential power development in the lower reach of the river that could well become a reality if additional water is made available by the elimination of nonbeneficial uses. Power development on the lower Pecos could provide additional assistance in meeting the rehabilitation problem of existing irrigation districts and help defray the cost of controlling the phreatophyte.

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